



Service & Maintenance Manual PS16W Electric Pallet Truck

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FOREWORD

Proper operation, maintenance, troubleshooting and repairs are necessary to preserve the performance of the pallet truck over along period of time and ensure that fault and breakdowns do not occur. The object of this service manual is to provide the information necessary especially in connection with the performance of inspections and repairs mainly in the maintenance areas.

WARNING

The majority of this pallet truck consists of steel, it can be completely recycled. Waste material in conjunction with repairs, maintenance, cleaning or scrapping, must be collected and disposed of in an environment-friendly way and in accordance with the directives of respective countries. Such work must be carried out in areas intended for this purpose. Recyclable material should be taken care of by specialized authorities. Environmentally hazardous waste, such as oil filters, batteries and electronics, will have a negative effect on the environment, or health, if handled incorrectly.

CAUTION

All of the information reported herein is based on data available at the moment of printing. Our products are constantly being developed and renewed, we reserves the right to modify our own products at any moment without prior notice and incurring in any sanction. So, it is suggested to always verify possible updates.

1. GENERAL

1.1 INTRODUCTION – MAINTENANCE SAFETY PRECAUTIONS

Careless performing of the easy work may cause injuries. Take care to always perform work safely, at least observing the following. It is of utmost importance that maintenance personnel pay strict attention to these warnings and precautions to avoid possible injury to themselves or others, or damage to the equipment. A maintenance program must be followed to ensure that the machine is safe to operate. The specific precautions to be observed during maintenance are inserted at the appropriate point in the manual. These precautions are those that apply when servicing hydraulic and larger machine component parts.

⚠ WARNING MODIFICATION OF THE MACHINE WITHOUT CERTIFICATION BY A RESPONSIBLE AUTHORITY THAT THE MACHINE IS AT LEAST AS SAFE AS ORIGINALLY MANUFACTURED, IS A SAFETY VIOLATION.

⚠ WARNING SINCE THE MACHINE MANUFACTURER HAS NO DIRECT CONTROL OVER THE FIELD INSPECTION AND MAINTENANCE, SAFETY IN THIS AREA RESPONSIBILITY OF THE OWNER OR OPERATOR.

⚠ WARNING FAILURE TO COMPLY WITH SAFETY PRECAUTIONS LISTED IN THIS SECTION MAY RESULT IN MACHINE DAMAGE, PERSONNEL INJURY OR DEATH AND IS A SAFETY VIOLATION.

- When carrying out any operation or maintenance, have trained and experienced personnel carry out the work.
- When carrying out any operation or maintenance, carefully read out Operation and Maintenance Manual.
- Read all the precautions given on the decals which are fixed to the machine.
- Be sure you fully understand the contents of the operation. It is important to prepare necessary tools and parts and to keep the machine.

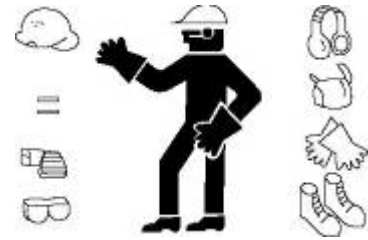
- Your safety, and that of others, is the first consideration when engaging in the maintenance of equipment. Always be conscious of weight. Never attempt to move heavy parts without the aid of a mechanical device. Do not allow heavy objects to rest in an unstable position. When raising a portion of the equipment, ensure that adequate support is provided.



- It should be noted that the machines hydraulic systems operate at extremely high potentially dangerous pressures. Every effort should be made to relieve any system pressure prior to disconnecting or removing any portion of the system. Relieve system pressure by cycling the applicable control lowering button several times with the motor stopped and ignition on, to direct any line pressure back into the reservoir. Pressure feed lines to system components can then be disconnected with minimal fluid loss.



- Remove all rings, watches and jewelry when performing any maintenance.
- Wear well-fitting helmet, safety shoes and working Clothes When drilling grinding or hammering always. Wear protective goggles. Always do up safety clothes properly so that they do. Not catch on protruding parts of machines. Do not wear oily clothes. When checking, always release battery plug. **DO NOT WEAR LONG HAIR UNRESTRAINED, OR LOOSE-FITTING CLOTHING AND NECKTIES WHICH ARE APT TO BECOME CAUGHT ON OR ENTANGLED IN EQUIPMENT.**

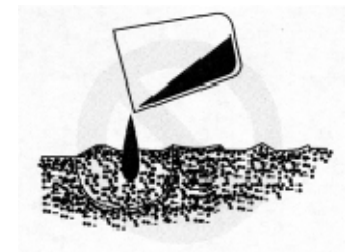


- During maintenance do not allow any unauthorized person, to stand near the machine.



- Flames should never be used instead of lamps. Never use a buring flame to check leaks or the level of oil or electrolyte.

- Immediately remove any oil or grease on the floor of the operator's compartment or on the handrail. It is very dangerous if someone slips while on the machine.



- Always use the recommended pure oil or grease, and be sure to use clean containers.

- Oil is a dangerous substance. Never handle oil, grease or oily clothes in places where there is any fire or flame. As preparation for use of fire extinguishers and other fire- fighting equipment.



- Keep the battery away from fire hazards. The generated gases are explosive.
- Store all the oils in a specified place.



- Keep the flammable things away from the machine. Do not smoke in the working site.
- Battery should always be disconnected during replacement of electrical components.

- Always use the grades of grease and oil recommended by NOBLELIFT choose the viscosity specified for the ambient temperature.



- Exhaust gas is dangerous provide ventilation when working in a closed space.
- Avoid breathing dust that may be generated when handling components containing asbestos fibers. Wear a gas mask if necessary.

- When working on top of the machine, be careful not to lose your balance and fall.

- Hand a caution sign in the operator's compartment (for example "Do not start" or "Maintenance in progress"). This will prevent anyone from starting or moving the machine by mistake.



- When welding on the machine or working on the electrical system, ALWAYS turn the key switch OFF and remove the battery plug from the battery. Park the machine on firm, flat ground. Lower the fork to the min. height and stop the motor.



- Sulfuric acid in battery electrolyte is poisonous. It is strong enough to burn skin and eat holes in clothing. If you spill acid on your clothes or skin, immediately flush it with large quantities of water.



- When working on the battery, wear goggles or safety glasses. If splashed into the eyes, flush with water and get medical attention immediately.

- Battery terminals touched by metal objects can cause short circuit and burn you. Keep tools away from the terminals.



- When disassembling and assembling the battery, make sure that the battery terminals (+, -) are correctly connected.

- If water gets into the electrical system, abnormal operation or failure can result. Do not use water or steam on sensors, connectors and instruments in the cab.



- Do not handle electrical equipment while wearing wet gloves, or in wet places, as this can cause electric shock.

- When working with others, choose a group leader and work according to his instructions. Do not perform any maintenance beyond the agreed work.

- Unless you have special instructions to the contrary, maintenance should always be carried out with the motor stopped. If maintenance is carried out with the motor running, there must be two men present : one operating the pallet truck and the other one performing the maintenance. In such a case, never touch any moving part.

- Before making adjustment, lubricating or performing any other maintenance, shut off all power controls.

- When removing parts containing O-ring Gaskets or seal. Make sure clean the mounting surface and replace with new sealing parts.
- Thoroughly clean the machine. In particular, be careful to clean the grease fittings and the area around the dipsticks. Be careful not to let any dirt or dust into the system.
- Use only approved, nonflammable cleaning solvents.
- When changing the oil or filter, check the drained oil and filter for any signs of excessive metal particles or other foreign materials.
- Always use NOBLELIFT genuine parts for replacement. ENSURE REPLACEMENT PARTS OR COMPONENTS ARE IDENTICAL OR EQUIVALENT TO ORIGINAL PARTS OR COMPONENTS.
- When checking an open gear case, there is a risk of dripping things in. Before removing the covers to inspect such cases, empty everything from your pockets. Be particularly careful to remove wrenches and nuts.

NOBLELIFT 诺力

1.2 MEASUREMENT CONVERSIONS

Length

Unit	cm	m	km	in	ft	yd	mile
cm	1	0.01	0.00001	0.3937	0.03281	0.01094	0.000006
m	100	1	0.001	39.37	3.2808	1.0936	0.00062
km	100000	1000	1	39370.7	3280.8	1093.6	0.62137
in	2.54	0.0254	0.000025	1	0.08333	0.02777	0.000015
ft	30.48	0.3048	0.000304	12	1	0.3333	0.000189
yd	91.44	0.9144	0.000914	36	3	1	0.000568
mile	160930	1609.3	1.6093	63360	5280	1760	1

1mm=0.1cm, 1 μ m=0.001mm

Area

Unit	cm ₂	m ₂	km ₂	a	ft ₂	yd ₂	in ₂
cm ₂	1	0.0001	–	0.000001	0.001076	0.000012	0.155000
m ₂	10000	1	0.000001	0.01	10.764	1.1958	1550.000
km ₂	–	1000000	1	10000	1076400	1195800	–
a	0.01	100	0.0001	1	1076.4	119.58	–
ft ₂	–	0.092903	–	0.000929	1	0.1111	144.000
yd ₂	–	0.83613	–	0.008361	9	1	1296.00
in ₂	6.4516	0.000645	–	–	0.006943	0.000771	1

1ha=100a, 1mile₂=259ha=2.59km₂

Volume

Unit	cm ₃ = cc	m ₃	l	in ₃	ft ₃	yd ₃
cm ₃ = m l	1	0.000001	0.001	0.061024	0.000035	0.000001
m ₃	1000000	1	1000	61024	35.315	1.30796
l	1000	0.001	1	61.024	0.035315	0.001308
in ₃	16.387	0.000016	0.01638	1	0.000578	0.000021
ft ₃	28316.8	0.028317	28.317	1728	1	0.03704
yd ₃	764529.8	0.76453	764.53	46656	27	1

1gal(US)=3785.41 cm₃=231 in₃=0.83267gal(US)

Weight

Unit	g	kg	t	oz	lb
g	1	0.001	0.000001	0.03527	0.0022
kg	1000	1	0.001	35.273	2.20459
t	1000000	1000	1	35273	2204.59
oz	28.3495	0.02835	0.000028	1	0.0625
lb	453.592	0.45359	0.000454	16	1

1 tonne(metric)=1.1023 ton(US)=0.9842 ton(UK)

Pressure

Unit	kgf/cm ₂	bar	Pa=N/m ₂	kPa	lbf/in ₂	lbf/ft ₂
kgf/cm ₂	1	0.98067	98066.5	98.0665	14.2233	2048.16
bar	1.01972	1	100000	100	14.5037	2088.6
Pa=N/m ₂	0.00001	0.00001	1	0.001	0.00015	0.02086
kPa	0.01020	0.01	1000	1	0.14504	20.886
lbf/in ₂	0.07032	0.0689	6894.76	6.89476	1	144
lbf/ft ₂	0.00047	0.00047	47.88028	0.04788	0.00694	1

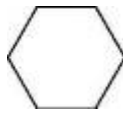

kgf/cm₂=735.56 Torr(mmHg)=0.96784atm

Standard torque



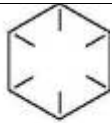
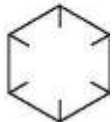
The following charts give the standard torque specification of bolts and nuts.

Exceptions are given in the sections of "Disassembly and Assembly"

METER TABLE

Classification	4T, 5T	10T
Bolt type		
Bolt size	Torque kgf · m (lbf · ft)	Torque kgf · m (lbf · ft)
M4	0.2 ± 0.02	0.4 ± 0.04
M5	0.3 ± 0.03	0.8 ± 0.08
M6	0.5 ± 0.05	1.4 ± 0.14
M8	1.2 ± 0.12	3.3 ± 0.3
M10	2.3 ± 0.23	6.5 ± 0.7
M12	4.0 ± 0.4	11.3 ± 1.1
M14	6.4 ± 0.6	17.9 ± 1.8
M16	9.5 ± 0.9	26.7 ± 2.7
M18	13.5 ± 1.4	38.0 ± 3.8
M20	18.6 ± 1.9	52.2 ± 5.2
M22	24.7 ± 2.5	69.4 ± 6.9
M24	32.1 ± 3.2	90.2 ± 9.0
M30	62.6 ± 6.3	176.1 ± 17.6
M36	108.2 ± 10.8	304.3 ± 30.4
M42	171.8 ± 17.2	483.2 ± 48.3
M45	211.3 ± 21.1	594.3 ± 50.4

INCH TABLE

	4T, 5T	10T
Classification Bolt type		  
Bolt size	Torque kgf · m (lbf · ft)	Torque kgf · m (lbf · ft)
1/4	0.6 ± 0.06	1.7 ± 0.2
5/16	1.2 ± 0.12	3.0 ± 0.3
3/8	2.0 ± 0.20	5.6 ± 0.5
7/16	3.2 ± 0.32	8.9 ± 0.9
1/2	4.7 ± 0.47	13.4 ± 1.3
9/16	6.8 ± 0.68	19.0 ± 1.9
5/8	9.3 ± 0.93	26.1 ± 2.6
3/4	16.0 ± 1.60	45.1 ± 4.5
7/8	25.5 ± 2.55	71.6 ± 7.2
1	38.0 ± 3.80	106.9 ± 10.7
1-1/8	54.1 ± 5.41	152.2 ± 15.2
1-1/4	74.2 ± 7.42	208.9 ± 20.9
1-3/4	98.8 ± 9.88	277.8 ± 27.8
1-1/2	128.2 ± 12.82	360.7 ± 36.1

The torque specifications in above table shall not be applied to the bolts with nylon packings and nonferrous metal washers, or the ones with specifically designated torque and standard.

H Newton meter : 1 N·m = 0.1kgf·m

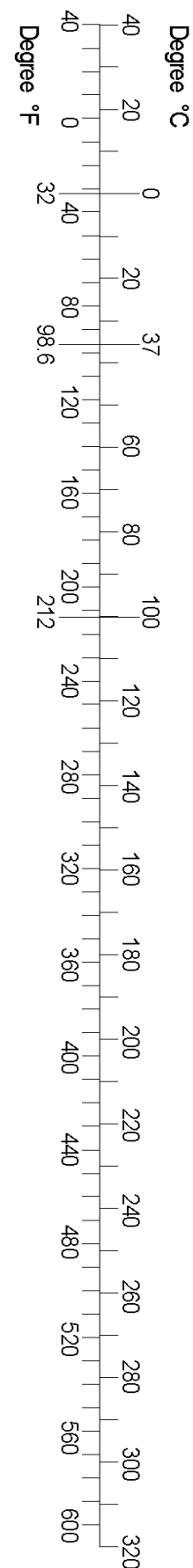
TIGHTENING TORQUE OF SPLIT FLANGE BOLTS

The following torque shall be applied to the split flange bolts.

Diameter (mm)	Flat width (mm)	Torque	
		kgf·m	N·m
10	14	6.7 ± 0.7	66.7 ± 6.8
12	17	11.5 ± 1	112 ± 9.8
16	22	28.5 ± 3	279 ± 29

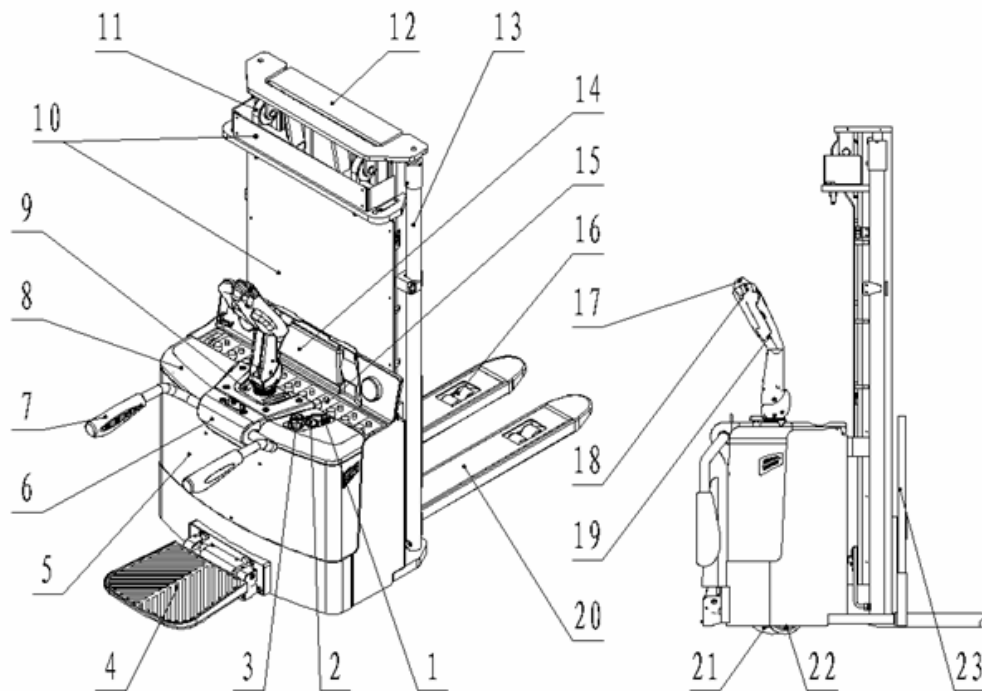
APPROXIMATE CONVERSIONS

SI Unit	Conv Factor	Non-SI Unit	Conv Factor	SI Unit
Torque				
newton meter (N·m)	× 8.9	= in·in	× 0.113	= N·m
newton meter (N·m)	× 0.74	= lb·ft.	× 1.36	= N·m
newton meter (N·m)	× 0.102	= kg·m	× 7.22	= lb·ft.*
Pressure (Pa = N/m ²)				
kilopascal (kPa)	× 4.0	= in. H ₂ O	× 0.249	= kPa
kilopascal (kPa)	× 0.30	= in. Hg	× 3.38	= kPa
kilopascal (kPa)	× 0.145	= psi	× 6.89	= kPa
(bar)	× 14.5	= psi	× 0.069	= bar*
(kg/cm ²)	× 14.22	= psi	× 0.070	= bar*
newton/mm ²	× 145.04	= psi	× 0.069	= bar*
megapascal (MPa)	× 145	= psi	× 0.00689	= MPa
(Pa=N·m ²)				
Power r (W = J/s)				
kilowatt (kW)	× 1.36	= PS (cv)	× 0.736	= kW
kilowatt (kW)	× 1.34	= HP	× 0.746	= kW
kilowatt (kW)	× 0.948	= Btu/s	× 1.055	= kW
watt (W)	× 0.74	= ft·lb/s	× 1.36	= W
(W=J/s)				
Energy (J = N·m)				
kilojoule (kJ)	× 0.948	= Btu	× 1.055	= kJ
joule (J)	× 0.239	= calorie	× 4.19	= J
(J=N·m)				
Velocity and Acceleration				
meter per sec ² (m/s ²)	× 3.28	= ft/s ²	× 0.305	= m/s ²
meter per sec (m/s)	× 3.28	= ft/s	× 0.305	= m/s
kilometer per hour (km/h)	× 0.62	= mph	× 1.61	= km/h
Horse Power/Torque				
BHP × 5252 R.P.M. = TQ (lb·ft) TQ Z R.P.M. 5252 = B.H.P.				
Temperature				
°C = (°F-32) ÷ 1.8 °F= (°C Z 1.8) + 32				
Flow Rate				
liter/min (dm ³ /min)	× 0.264	= US gal/min	× 3.785	= l/min
Note : () Non-SI Unit				



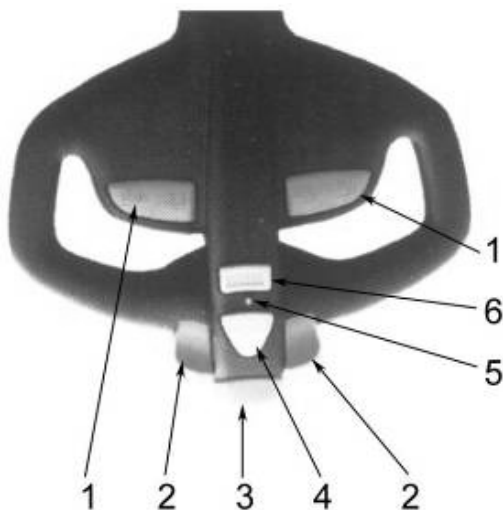
2. SPECIFICATIONS

2.1 LOCATION OF COMPONENTS



1. Key switch	13. Hydraulic cylinder
2. Discharge indicator and charging indicating LED	14. Battery cover
3. Emergency button	15. Battery
4. Foldable platform	16. Load wheels
5. Main cover	17. Safety (belly) button
6. Protective arm cover	18. Accelerator (butterfly button)
7. Protective arm	19. Tiller
8. Upper cover	20. Forks
9. Middle cover	21. Drive wheel
10. Protective screen	22. Castors
11. Chain	23. Load backrest
12. Mast	

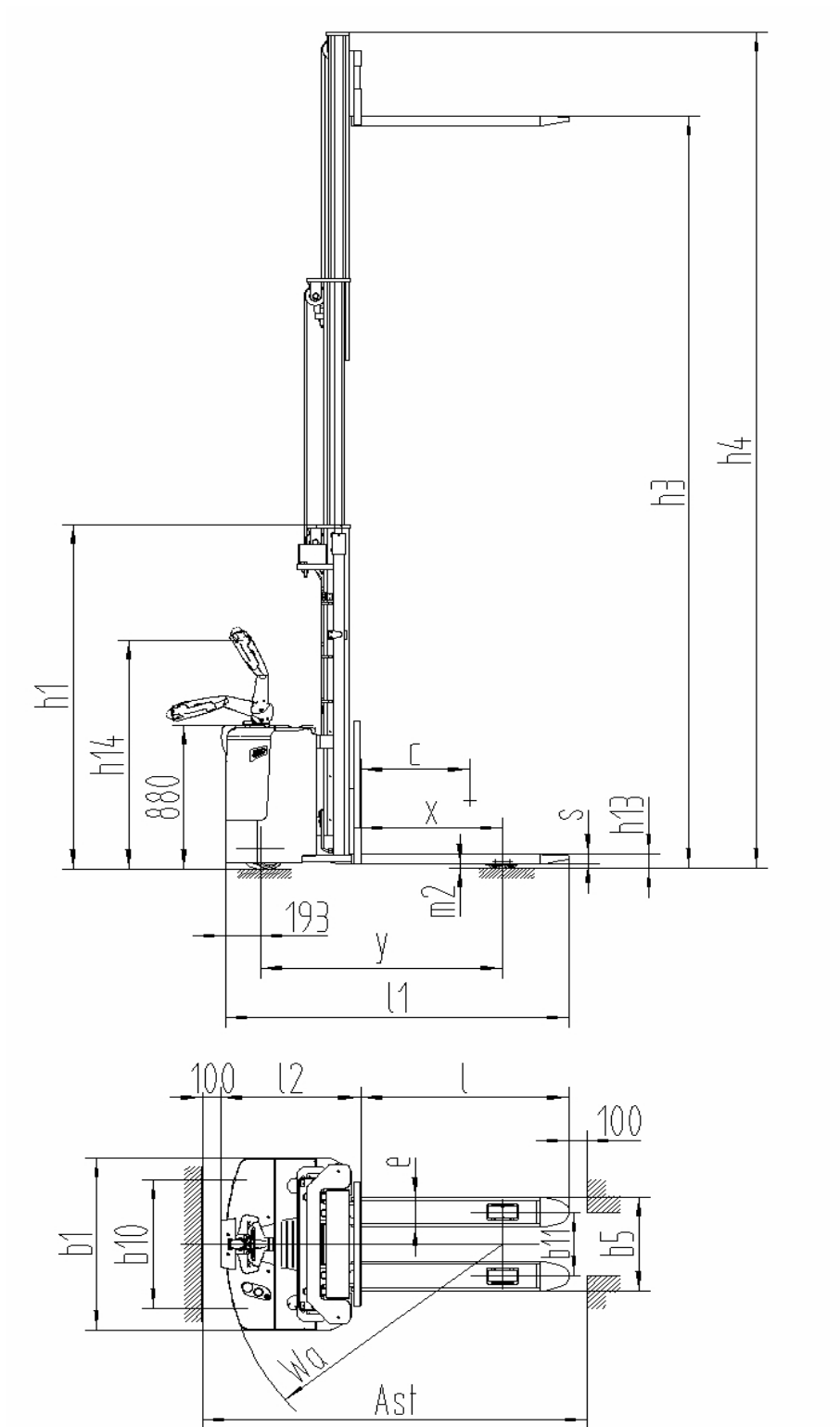
CONTROL HANDLE



- 1. Raise/Lower buttons** – Rocker switches adjusting fork height.
- 2. FWD/BWD/REV travel button** –Control variable speed by turning knob
- 3. Emergency Reverse button** – Emergency reverse button or commonly known as the belly button switch
- 4. Horn button**
- 5. Indicator light** – Indicates high/low speed status. Green indicates high speed, red indicates slow speed.
- 6. Shift button** – Shift button for high speed and low speed

2.2 SPECIFICATION SHEETS

Type sheet for industrial truck acc. to VDI 2198				
Distinguishing mark	1.2	Manufacturer's type designation		PS 16W
	1.3	Power (battery ,diesel, petrol, gas, manual)		Battery
	1.4	Operator type		Pedestrian
	1.5	Load Capacity / rated load	Q(t)	1.6
	1.6	Load centre distance	c(mm)	600
	1.8	Load distance ,centre of drive axle to fork	x(mm)	784
	1.9	Wheelbase	Y(mm)	1336
Weight	2.1	Service weight	kg	1450
	2.2	Axle loading, laden front/rear	kg	1400/1650
	2.3	Axle loading, unladen front/rear	kg	1130/320
Tires, Chassis	3.1	Tires		Polyurethane (PU)
	3.2	Tire size, front	Ø x w (mm)	Ø252 × 88
	3.3	Tire size, rear	Ø x w (mm)	Ø80 × 70
	3.4	Additional wheels(dimensions)	Ø x w (mm)	Ø150× 54
	3.5	Wheels, number front/rear(x=driven wheels)		1x+2 / 4
	3.6	Tread, front	b10mm	790
	3.7	Tread, rear	b11 (mm)	390/ 505
Dimensions	4.2	Lowered mast height	h1 (mm)	2105
	4.3	Free Lift height	h2 (mm)	-
	4.4	Lift	h3 (mm)	4600
	4.5	Extended mast height	h4 (mm)	5112
	4.9	Height of tiller in drive position min./ max.	h14mm	961/ 1396
	4.15	Height, lowered	h13mm	85
	4.19	Overall length	l1mm	1895/1995
	4.20	Length to face of forks	l2mm	746/846
	4.21	Overall width	b1mm	1050
	4.22	Fork dimensions	s/e/l (mm)	60/180/1150
	4.25	Distance between fork- arms	b5 (mm)	570/ 685
	4.32	Ground clearance, centre of wheelbase	m2mm	25
	4.33	Aisle width for pallets 1000X1200 crossways	Ast (mm)	2403/2503
	4.34	Aisle width for pallets 800X1200 lengthways	Ast (mm)	2314/2414
	4.35	Turning radius	Wa (mm)	1540/1640
Performance data	5.1	Travel speed, laden/ unladen	km/h	6.0 / 6.0
	5.2	Lift speed, laden/ unladen	m/s	0.10/0.16
	5.3	Lowering speed, laden/ unladen	m/s	0.095/0.12
	5.8	Max. gradeability, laden/ unladen	%	6 / 12
	5.10	Service brake		Electromagnetic
Electric-Motor	6.1	Drive motor rating S2 60min	kW	1.3
	6.2	Lift motor rating at S3 15%	kW	3.0
	6.3	Battery acc. to DIN 43 531/35/36 A,B,C,no		No, cells 4PzS
	6.4	Battery voltage, nominal capacity K5	V/Ah	24/ 280
	6.5	Battery weight	kg	253
	6.6	Energy consumption acc. to VDI cycle	kWh/h	1.4
Additional data	8.1	Type of drive control		AC- speed control
	8.4	sound level at driver's ear acc. to EN 12053	dB(A)	70



2.3 LUBRICATION

Hydraulic oil

⚠ CAUTION Hydraulic oil must have anti-wear qualities at least. It is not advisable to mix oils of different brands or types, as they may not contain the same required additives or be of comparable viscosities.

Name: Thickened hydraulic oil.

ISO Viscosity Grade			#40	#30
Characteristics		unit		
Viscosity	At 40°C	mm ² /s	57	48
	At 50°C		40	30
Viscosity index			≥ 150	≥ 150
Flash point, Cleveland open cup		°C	≥ 160	≥ 160
Pour point, Max		°C	≤ -35	≤ -35
Density at 15 °C		kg/m ³		861.5
Copper corrosion(100°C, 3h)		degree	≤ 1	≤ 1
Foaming (93.5 °C)		ml / ml	≤ 30/0	≤ 30/0
Vickers vane pump test, loss of mass (on vanes after 100h)		mg	≤ 100	15.3
Diameter of wear spot, 1200 r/min, 294N, 30min, 75 °C		mm	≤ 0.5	≤ 0.5

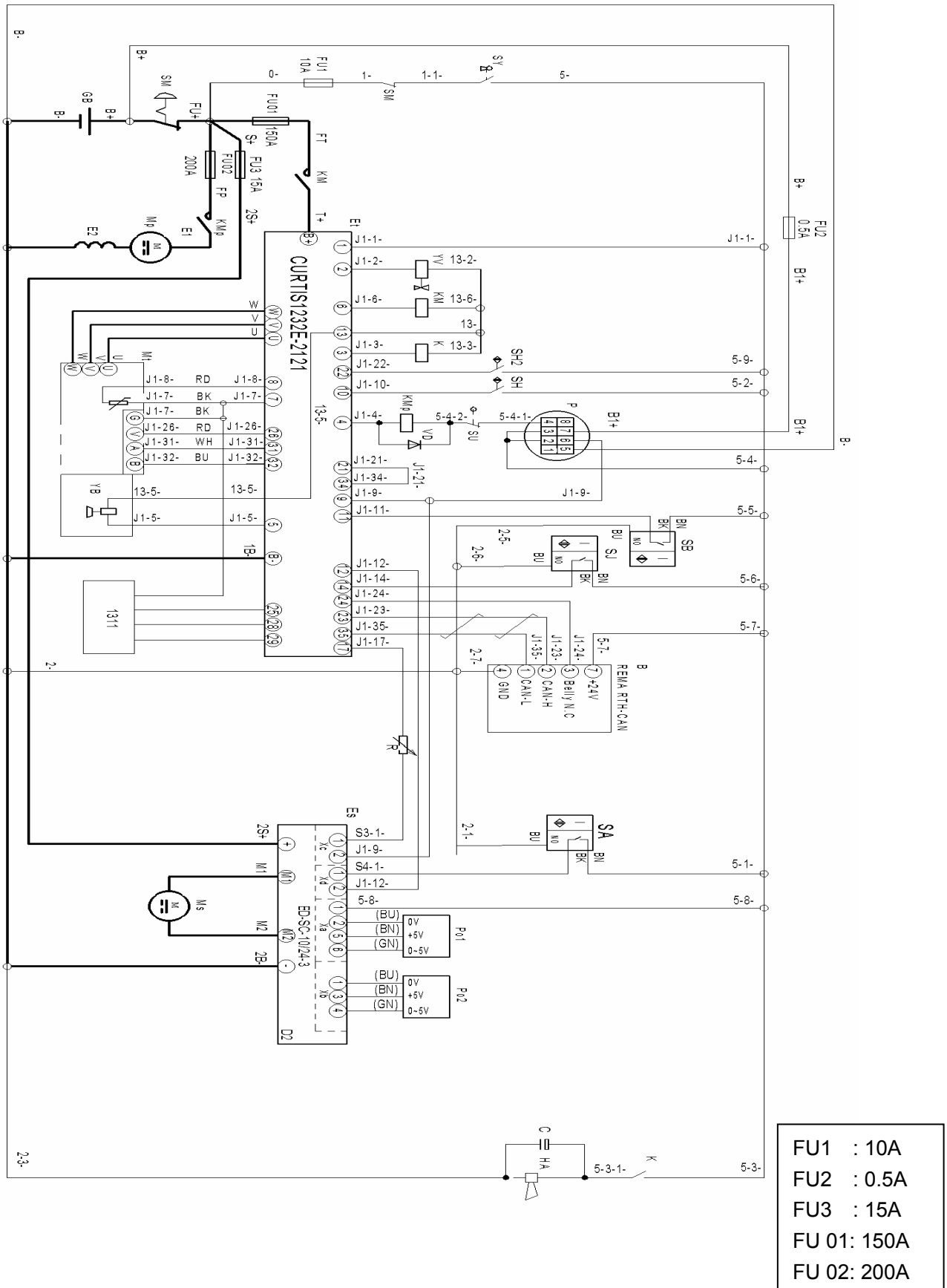
The oil for gear box

Name: Extreme pressure lithium-based grease, 1#.

Characteristics	unit	
Worked Penetration, 0.1mm		310--340
Dropping point,	°C	≥ 170
Extreme pressure (Timken OK)	N	≥ 177
Similar viscosity (-10 °C, 10s ⁻¹)	Pa. s	≤ 250
Corrosion preventive properties (52 °C, 48h)	Grade	1
Wire points oil (100 °C, 24h)	%	≤ 10

3. ELECTRICAL SYSTEM

3.1 ELECTRICAL DIAGRAM WIRING DIAGRAM



3.2 DRIVE WHEEL

Type: 26EL-AC-1.3 KW

Drive Motor	
Model	HPQ1.3-4BT3
Rate voltage	16V AC
R.P.M	3200rpm
Rate output	1.3kw
Rate hour	60min.
Rated current	76.2A
Amperager rating- max	110.7HZ
Insulation class	H
Gear Box	
transmission ratio	i=1:30

3.3 PUMP UNIT

Type: MR2-B-V1B-F4.5-PCMAV1Y-TK05C-F2

Item	Specification
Rated voltage	24V
Rated output	3.0kw
R.P.M	3300 rpm
Rated current	200 A
Rated hour	4.0 min.
Insulation class	F class
IP Code	IP43
Displacement	3.2cc/rec
Max. operating pressure	200bar

3.4 BATTERY

Rate	Specification
	PS16W
Rated voltage	24V
Capacity (5 hours)	280Ah
Box size (L*W*H)(mm)	645X244X570
Cell size (L*W*H)(mm)	77x158x525

Initial charge

- When the battery is charged for the first time, you should prepare the exclusive sulfuric acid and exclusive water of lead acids (If no exclusive water is present in local areas, distilled water can be used).

Slowly pour sulphuric acid into a container containing exclusive water(or distilled water), and churn it up with an acid-resistant stick. Keep it still until the fluid temperature drops to 35°C, then it can be poured into cells. The concentration of confected electrolyte is 1.280 ± 0.005 (25 °C).

The conversion formula of electrolyte is: $S_{25} = S_t + 0.0007 * (t - 25)$

which:

S_{25} : The concentration of electrolyte in standard temperature of 25°C

S_t : The actually measured concentration of electrolyte.

T: Actually measured temperature.

When confecting electrolyte, avoid pouring water into concentrated sulphuric acid, for fear that sulphuric acid splashes and leads to physical injury. In addition, please wear protective appliance.

- Wipe up the cells, check the nuts be tight for reliable connection.
- Pour configured electrolyte into grouped batteries, with fluid level 15-20mm higher than protective slice. Keep it still for 4-6 hours (maximum duration no more than 12 hours). Only when the cells temperature drops below 35°C can it be connercted to DC and charge. If cell's temperature exceeds 35°C , it should be taken to cool it down.
- Check the cells in the battery for reverse polarity with DC voltmeter to assure proper polarity. Connect the anode of the power supply to "+" of the battery, the cathode of the power supply to "-" of the battery. Avoid reverse polarity for fear of reverse charging. The voltage of the charge power supply should be higher than 1.5 times of the charged battery. When all the work is properly done, the cells can be charged according to parameters outlined in the list below:

Model	Charging current (A)			
	initial charge		common charge	
	Phase 1 ($0.5 I_5\text{A}$)	Phase 2 ($0.25 I_5\text{A}$)	Phase 3 ($0.7 I_5\text{A}$)	Phase 4 ($0.35 I_5\text{A}$)
210Ah	21	10.5	29	14.5
280Ah	28	14	39	19
350Ah	35	17	49	24

- Initial charges are conducted in 2 phases: in phase1, when terminal voltages of the cells rise to 2.4V, the current should be converted into phase2, and continue to charge until air bubbles come out from the electrolyte, keep cell voltage(under constant current) steady for 3 hours. When the concentration of confected electrolyte reaches 1.280 ± 0.005 , it should remain unchanged within 3 hours. At this moment, the total quantity of electric charge should be 4-5 times the rated capacity, and the charging duration will be 70 hours.
- If the concentration of the electrolyte is not 1.280 ± 0.005 , it should be adjusted. The method is: if the concentration is too high, draw out some electrolyte and add some water or distilled water, until the concentration equals to the prescribed value; if the concentration is too low, draw out some electrolyte and add some pre-confected dilute sulfuric acid with a concentration of $1.400\text{g}/\text{cm}^3$, until the concentration equals to the prescribed value. When the concentration of electrolyte is adjusted, it should be charged for 1 hour for consistency. The density-ratio of electrolyte is as follows:

Concentration of electrolyte	Volumeratio of water to sulfuric acid	Capacity ratio of water to sulfuric acid
1.100	9.80:1	5.84:1
1.200	4.33:1	2.36:1
1.270	2.80:1	1.57:1
1.280	2.75:1	1.49:1
1.400	1.90:1	1.00:1

- After charging, close the vent plug , and it only can be put into use after its surface is cleaned clear.

Balanced charge

When in use, nonuniformity of voltage capacity, electrolyte and concentration may occur. Through balanced charge, such nonuniformity can be eliminated, and all cells in the battery can be of uniform conditions. Balanced charge is essential monthly for the batteries in use or following situation:

- ◆ Cells whose discharge voltages are usually below the final voltage (1.7V/cell).
- ◆ Cells with heavy discharge current (in circumstances where the drive motor and lift motor operate synchronously with heavy load), or in circumstance with steep slope.
- ◆ Cells not timely recharged after discharged.
- ◆ Undercharged cells of cells not used for a long time.

METHODS OF BALANCED CHARGE:

Normally charge the cells, when it is fully charged, shut off the charge power supply, keep it still for half an hour, then switch on the power supply and continue to charge with the current of phase 2. When air bubbles come out, convert to 1/2 of the current of phase 2 and continue to charge the cells, when air bubbles are produced, shut off the charge power supply, keep it still for half an hour, then switch on the power supply and continue to charge with 1/2 of the current of phase 2, until air bubbles are produced, stop charging and left it still. Repeat the procedure for several times, until air bubbles are produced as soon as power supply is connected. In balanced charge, voltage of each cell as well as the electrolyte concentration should be measured and recorded. Before the charge is completed, the electrolyte concentration and height should be adjusted to the prescribed parameters.

SULFURIC ACID FOR CELLS

Index name	Index
Sulphuric acid (H ₂ SO ₄)	% ≥92
Ignition residue	% ≤0.03
Manganese (Mn)	% ≤0.0005
Ferrum(Fe)	% ≤0.005
Arsenic(As)	% ≤0.00005
Chlorine(Cl)	% ≤0.0005
Nitrogenoxides(calculatedby N)	% ≤0.0001
Ammonia salt (NH ₄)	% ≤0.001
Sulfur dioxide(SO ₂)	% ≤0.004
Copper (Cu)	% ≤0.0005
Deoxidized potassium permanganate (O)	% ≤0.001
Chorma	ml ≤1.0
Transparency	mm ≥160

WATER FOR LEAD ACID CELLS

Index name	Index	
	%	Mg / l
Appearance	Achromatic, transparent	
Residue content ≤	0.01	100
Manganese (Mn) content ≤	0.00001	0.1
Ferrum(Fe) content ≤	0.0004	4
Chlorine(Cl) content ≤	0.0005	5
Ammonia salt content ≤	0.0003	3

Ammonia (NH ₄) content	≤	0.0008	8
Deoxidized potassium permanganate (O) content	≤	0.0002	2
Solomets metal oxide (CaO) content	≤	0.005	50
Resistivity (25°C) Ω·cm	≥	10×10 ⁴	

ELECTROLYTE FOR LEAD ACID CELLS

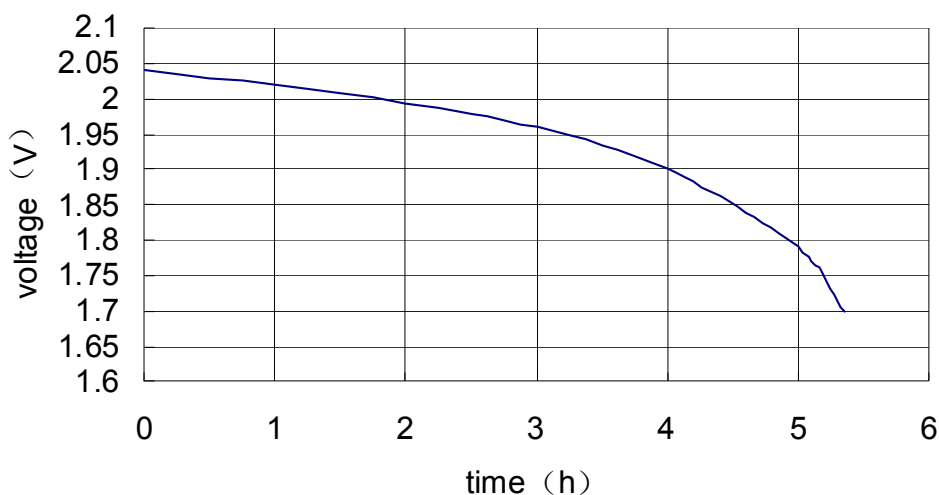
Index name	Index	
	%	Mg / l
Appearance	Achromatic, transparent	
Sulphuric acid (H ₂ SO ₄) content	15~40	180~480
Concentration 50°C, g/cm ³	1.1~1.3	
Ignition residue content	≤ 0.02	0.24
Manganese (Mn) content	≤ 0.00004	0.00048
Ferrum (Fe) content	≤ 0.004	0.048
Arsenic (As) content	≤ 0.00003	0.00036
Chlorine (Cl) content	≤ 0.0007	0.0084
Ammonia salt content (N)	≤ 0.0005	0.006
Copper (Cu) content	≤ 0.002	0.024
Deoxidized potassium permanganate content	≤ 0.0008	0.01
Content calculated by KMnO ₄	≤ 0.0032	0.038



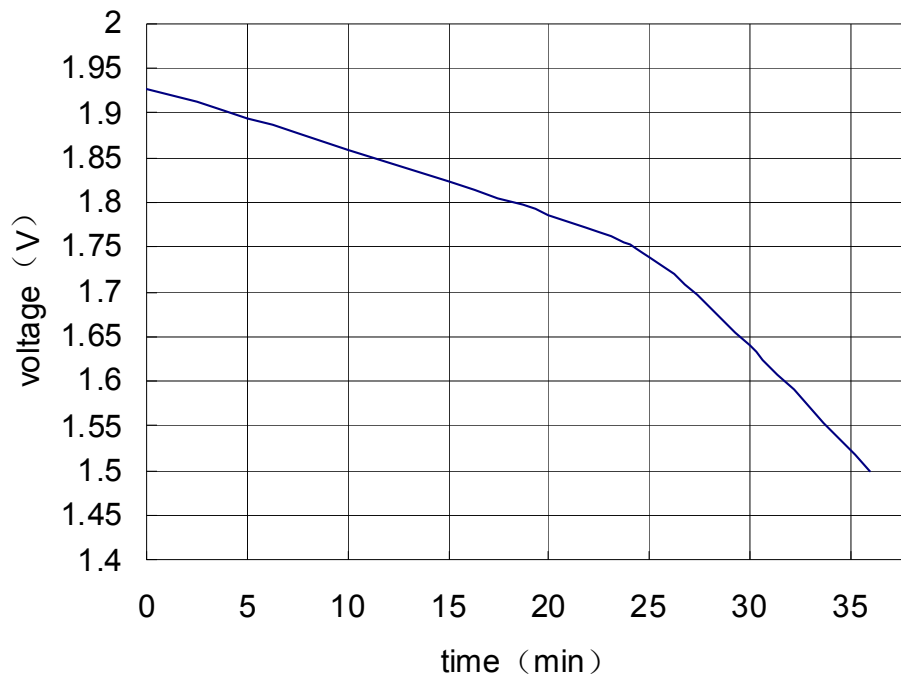
Don't spatter electrolyte or water into the batteries otherwise the battery tank will be eroded and the battery will automatically discharge, which will lead to low performance of battery and even shorter life. If electrolyte or water are spattered into the unintentionally, please discharge with the exclusively equipped plastic pipes.

DISCHARGE CURVE

5hr discharge curve



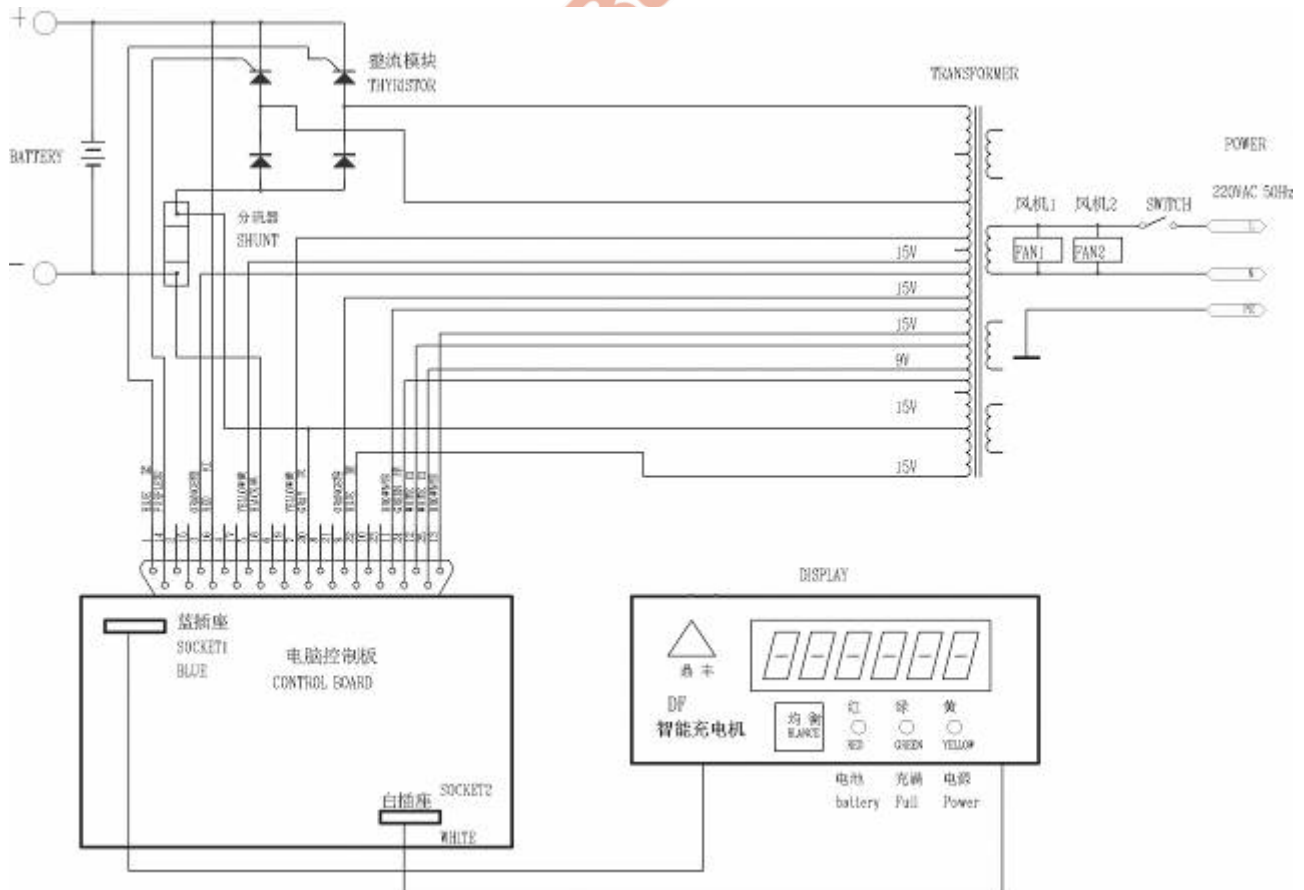
0.5hr discharge curve



3.5 CHARGER

Type: DF2440 for 24V/280Ah

WIRING DIAGRAM FOR CHARGER





WARNING The battery generates flammable and explosive gases during charge, so excellent ventilation is required. Open the liquid refilling cap or seal cap. Do not smoke around the battery during charge. Any fire and spark is forbidden.

MAIN PRODUCT SPECIFICATION

Type	Input power	Battery capacity	Input voltage	Output voltage	Output current range
DF2440	1.9KVA	270-300	220v	31.2	40A

ENVIRONMENTAL CONDITION

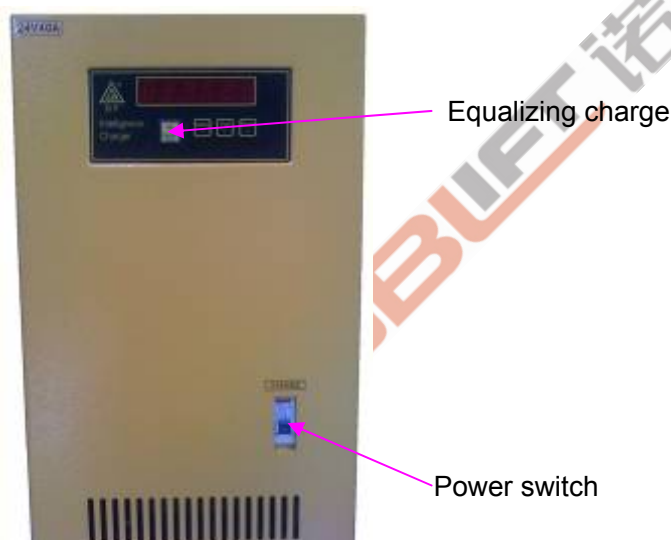
No.	Item	Technical specification	Unit	Remark
1	Humidity	5%-80%		With package
2	Altitude	≤2000	m	Work normally
3	Cooling	Fan convection cooling		Working under full load

ELECTRICAL CHARACTERISTICS

1 Input characteristics				
No.	Item	Technical specification	Unit	Remark
1.1	Rated input voltage	220	Vac	220Vac
1.2	Input voltage range	209-231	Vac	
1.3	AC input voltage frequency	50—60	Hz	
1.4	Max input current	DF2440: 8	A	
1.5	Fan function	When input is on,voltage for fan,When input voltage is off,there is no output voltage for fan		
2 Output characteristics				
No.	Item	Technical requirements	Unit	Remark
2.1	Fast charge voltage	28.8	Vdc	
2.2	Floating voltage	31.2	Vdc	
2.3	Maintain voltage	28.8	Vdc	
2.4	Constant current	DF2440: 40	A	
2.5	Power efficiency	≥80%		
3 Protection characteristics				
No.	Item	Technical requirements	Unit	Remark
3.1	Output over voltage protection	32	V	
3.2	Thermal protection	When the transformer temperature is higher than 125 ℃ -130 ℃ , the charger automatically protect, stop charging.		

3.3	Output current limiting protection	DF2440: 40	A	
3.4	Output short circuit protection	If a short circuit load, the charger will be protected and will not work.		
3.5	Electronic reverse battery protection	The charger is electronically protected against permanent revers battery connection		
4	Charger(LED) indicator			
No.	Item	Status LED		Remark
1	Power on	Power LED on (Yellow)		
2	Power off	Power LED OFF		
3	Fast Charge	Full LED ON (RED)		
4	Floating Charge	Full LED ON (RED)		
5	Full Charging	LED ON (GREEN)		
6	Fault LED	Battery LED (RED)		

DF2440 charger



BEFORE CHARGING

- The charger shall be installed in a special, ventilated, dry, no dust, no corrosive gas, no interference from high electromagnetic field place. The shell of the charger should be earthed (the ground bolts are equipped at the lower part of the case).
- The charger is only available for indoors, off-board charger. No water should be in the charger.
- The input power supply is 1- phases, $220V \pm 5\% \sim 230V \pm 5\%$, 50Hz or $110V \pm 5\%$, 50Hz. The lead section shall be no less than 4 mm^2 , while the capacity of mains switch shall be no less than 30A. You are recommended to use the dynamic mains switch.
- Appropriate cables may be employed according to the distance between power supply and the charger, which makes the voltage drop no more than 5%.
- Applicable environmental temperature for the charger is from -10°C to 40°C and the height less than 1000 meters. During use, the stumbling block that affects heat radiation of the charger shall be 0.6 meter away from it. Please check the blower is running normally or not regularly.
- In case of failure of microcomputer controller, please inform the service engineer or maintenance

staff.

- Check height of electrolyte in the battery in accordance with the manufacturer's instructions.

COMMON CHARGE

- Connect cable plug of the battery to corresponding output plug of the charger firmly. Connect the battery firstly, then connect it to the power supply and finally start it. If the output plug is connected to the electric control terminal of the vehicle mistakenly, the charger fails to work, the indicator light for "failure" is on, please correct it timely.
- Connect the charger to power supply first, then turn on the power air switch and the charger starts after the power is connected. The indicator light for power supply is on and the charger is under self-examination condition. The display indicates current system version, chargeable battery voltage, current battery voltage, maximum chargeable current and other data.
- After the self-examination process is completed, the charger begins charging. The display indicates voltage[**.*V], charge current [**.*A], charge time[H**.*] (shows ** Hour, ** Minute) and charged electric quantity [***AH].
- When the display indicates "Charge completion" and the indicator light is on, the battery finishes charge. The charger enters floating charge, with current of 1-3 amperes. Please check electrolyte height in the battery frequently and fill distilled water timely as required.
- Disconnect the power switch, and disconnect the output cable plug of the charger and plug of battery and the charge is completed.

EQUALIZING CHARGE

When the battery group has been used for some time, the performance parameters of the batteries may vary differently, so equilibrium (constant current) charge is required.

If equalizing charge is required, press the key for "Balance" charge, turn on the power switch, then the indicator light for "Balance" is on. The charger enters into equalizing charge status, the current value reduces from the rated value to a constant current value during charge, meanwhile, the display indicates "-FC-". When the equalizing charge is completed, manual turning off is required (note: the output current of the charger under equalizing charge is constant without stop, manual turning off is necessary). Press the key for "Balance" charge after turning off the charger to make it return to normal charge.

⚠ WARNING The equalizing charge is a manual operation. Appointed personnel are required to observe and check voltage and specific gravity of the batteries and determine charge time, manual power off and charge stop as required.

TROUBLESHOOTING

Failures	Causes	Troubleshooting
The indicator light for power is on, the indicator light for failure is on, the blower is on, the charger can not start and charge and the monitor is not display .	The battery is not connected, or the output plug of the charger is inserted into the controller plug of the electric vehicle.	Connection of the battery should be corrected.
The indicator light for power is on, the indicator light for failure is on, the blower is on, the	① Although the charger and battery is connected, however, some part of which is	① Check each connection bolt and wiring.

charger can not start and charge and the monitor is not display .	<p>disconnected.</p> <p>②The battery is aging, becomes invalid and low voltage.</p> <p>③The battery is connected oppositely.</p>	<p>② Check total voltage of battery and each single voltage of the battery. In case of open circuit, aging, invalid, low voltage of the battery, please change a new one.</p> <p>③ Correct the incorrect connection.</p>
The indicator light for power is on, the indicator light for failure is on, the blower is on, the charger can not start and charge and the display.	Failure of DC output fuser.	Open the side door to check the fuser. If the fuser is broken, please change a new one.
Instable charge current, more or less.	Long-term heating, poor contact or loose by the output plugs.	Check the copper plates, if it is unavailable, please change a new one.
Instable charge current, not reaching the rated current value.	<p>① Low power voltage.</p> <p>② Small section area of lead for power input.</p>	<p>① The power voltage may not lower than 95% of the rated voltage. If the voltage is too low, please change a new power supply.</p> <p>② The section area of input lead of power supply may not less than the stipulated section area in the manual.</p>
Air switch of the charger does not trip, and the preceding stage switch trips.	<p>① Failure of the preceding air switch.</p> <p>② Incorrect matching of air switch.</p> <p>③ Small capacity of the air switch.</p>	<p>Rated current of the preceding stage air switch is more than that of the air switch of the charger.</p> <p>The air switch must be type D (dynamic type), type C (illumination type) is unavailable.</p>
Excessive overcharge for the battery.	Internal short circuit of single battery of the group.	Check each terminal voltage of every single battery. If some of the voltages are lower than their nominal voltages, the internal polar plates suffers from short circuit, please remove them and change new ones.
The display signals of the display face rolling, deadlock and clobber.	Failure of microcomputer or control power.	Please inform the service engineers.

3.6 CURTIS CONTROLLER



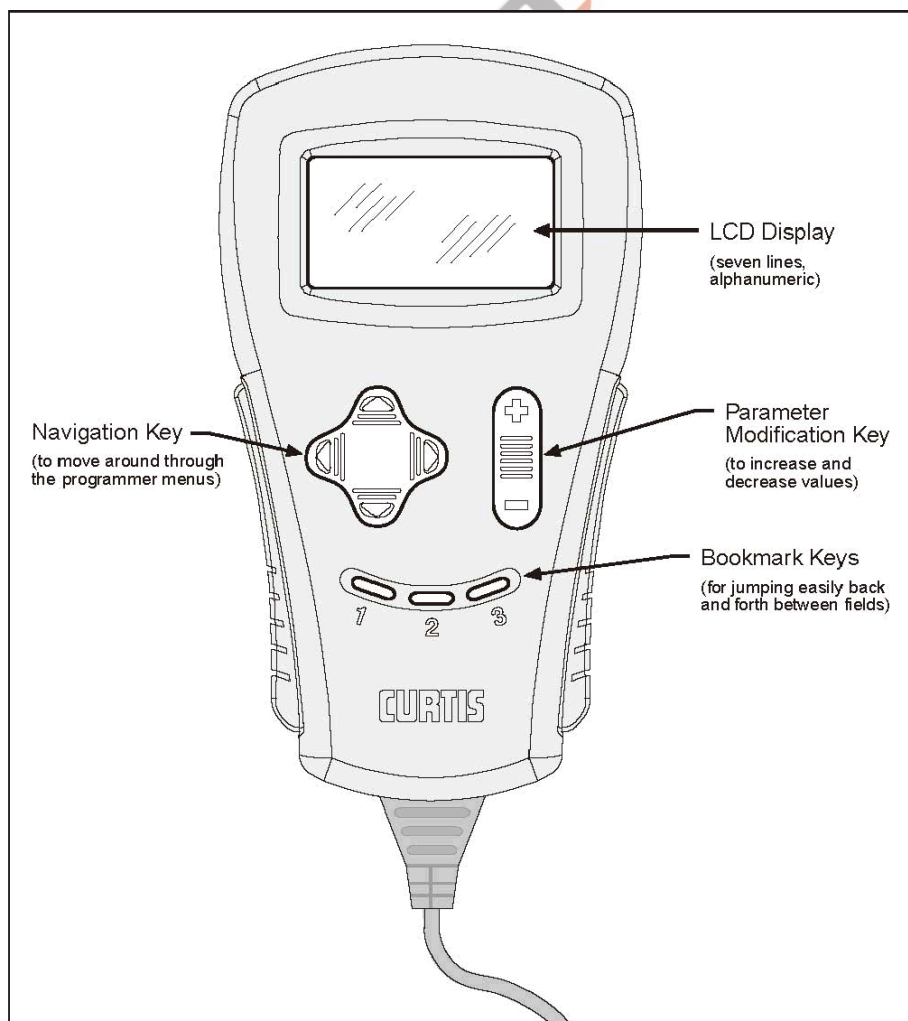
CURTIS 1311 HANDHELD PROGRAMMER

The Curtis 1311 handheld programmer provides programming, diagnostic, and test capabilities for the controller. The power for operating the programmer is supplied by the host controller via a 4-pin Molex connector.

The programmer includes a 7-line alphanumeric LCD display, rockertype keys for navigating through the display and for modifying parameters (+/-), and three keys that can be used as bookmarks.

The 1311 programmer is easy to use, with self-explanatory functions. After plugging in the programmer, wait a few seconds for it to boot up and gather information from the controller.

For experimenting with settings, the programmer can be left plugged in while the vehicle is driven.



The bookmark keys allow you to quickly go back to up to three selected items without having to navigate back through the menu structure. To set a bookmark, press one of the bookmark keys for about three seconds, until the Bookmark Set screen is displayed. To jump to a set bookmark location, quickly press the appropriate bookmark key (1, 2, or 3). Note that the bookmarks are not permanently stored in the programmer. They are cleared when the programmer is unplugged.

The bookmark keys can be used to make parameter adjustment easier. For example, in adjusting the throttle deadband, you might set a bookmark at the Throttle % readout [Monitor > THROTTLE %] and another at the Throttle Deadband parameter [Program > THROTTLE DB]; this way you can easily toggle between the readout and the parameter.

Connect the 1311 handheld programmer to the truck and switch on the power, Program parameter shown as below:

Menu 2	Menu 3	Menu 4	Menu 5	Value	Min	Max	Unit
Mode Settings							
	Mast Momentary Switch Enable			On	Off	On	
	PD control Enable			Off	Off	On	
	Motor type define			1	0	32767	
	High Speed Mode						
		Max Speed		4200	0	5000	rpm
		Drive Current		100	5	100	%
		Accel Rate		1.8	0.1	30	Seconds
		Decel Rate		1.5	0.1	30	Seconds
	Speed limitation set						
		Mast High Max Speed		2100	0	5000	rpm
		Turning Switch Max Speed		2100	0	5000	rpm
		Arm close Standon Max Speed		4200	0	5000	rpm
		Arm close Wakier Max Speed		4200	0	5000	rpm
		Arm open Wakier Max Speed		4200	0	5000	rpm
		Arm open Standon Max Speed		4200	0	5000	rpm
		Turtle Max Speed		2100	0	5000	rpm
	Interlock brake						

	decel rate						
		Mast high Mode		3	0.1	30	Seconds
		Mast low Mode		1	0.1	30	Seconds
	Steer Angle Speed Reduction						
		Max Speed		4201	0	6000	rpm
		Steer Angle Max (Deg)-Left		0	0	180	
		Steer Angle Deadband (Deg)-Left		70	0	180	
		Steer Angle Deadband (Deg)-Right		110	0	180	
		Steer Angle Max (Deg)-Right		180	0	180	
		Full Turn Speed		30	0	100	%
	Hydro Setting						
		Current set					
		Lower PD Max Current		0.7	0.0 1	2	Ampere
		Lower PD Min Current		0.35	0.0 1	2	Ampere
		Step1 Lower follow lift PD Max Current		0.35	0.0 1	2	Ampere
		Step1 Lower follow lift PD Min Current		0.35	0.0 1	2	Ampere
		Step2 Lower follow lift PD Max Current		0.35	0.0 1	2	Ampere
		Step2 Lower follow lift PD Min Current		0.35	0.0 1	2	Ampere
		Lift PD Max Current		0.68	0.0 1	2	Ampere
		Lift PD Min Current		0.02	0.0 1	2	Ampere
		Pot input					
		Lift Pot Min		50	0	4095	
		Lift Pot Max		4050	0	4095	
		Lower Pot Min		50	0	4095	
		Lower Pot Max		4050	0	4095	
		Delay set					

			Pump to Lift Delay	0.1	0.1	30	Seconds
			Delay PD closed after Pump lift	1.5	0.1	30	Seconds
			Delay Lower after lift	0.8	0.1	30	Seconds
Control Mode Select				0	0	2	
0 - Speed Mode Express							
	Max Speed			3048	100	8000	rpm
	Kp			20	0	100	%
	Ki			20	5	100	%
	Accel Rate			1.8	0.1	30	Seconds
	Decel Rate			1.5	0.1	30	Seconds
	Brake Rate			1	0.1	30	Seconds
	Pump Enable			Off	Off	On	
1 - Speed Mode							
	Speed Controller						
		Max Speed		3048	100	8000	rpm
		Kp		20	0	100	%
		Ki LS		20	5	100	%
		Ki HS		30	5	100	%
		Vel Feedforward					
			Kvff	0	0	500	Ampere
			Build Rate	1	0.1	5	Seconds
			Release Rate	0.4	0.1	5	Seconds
		Acc Feedforward					
			Kaff	0	0	500	Ampere
			Kbff	0	0	500	Ampere
			Build Rate	1	0.1	5	Seconds
			Release Rate	0.4	0.1	5	Seconds
	Response						
		Full Accel Rate HS		3.6	0.1	30	Seconds
		Full Accel Rate LS		1.8	0.1	30	Seconds
		Low Accel Rate		10	0.1	30	Seconds
		Neutral Decel Rate HS		1.5	0.1	30	Seconds
		Neutral Decel Rate LS		3	0.1	30	Seconds
		Full Brake Rate HS		1	0.1	30	Seconds
		Full Brake Rate LS		2	0.1	30	Seconds

		Low Brake Rate		1.5	0.1	30	Seconds
		Fine Tuning					
			Partial Decel Rate	6	0.1	30	Seconds
			HS (High Speed)	70	0	100	%
			LS (Low Speed)	30	0	100	%
			Reversal Soften	20	0	100	%
			Max Speed Accel	1	0.1	30	Seconds
			Max Speed Decel	0.5	0.1	30	Seconds
	Pump Enable			Off	Off	On	
2 - Torque Mode							
	Speed Limiter						
		Max Speed		4000	500	8000	rpm
		Kp		30	0	100	%
		Ki		30	5	100	%
		Kd		10	0	100	%
	Response						
		Accel Rate		1	0.1	30	Seconds
		Accel Release Rate		0.4	0.1	2	Seconds
		Brake Rate		1	0.1	5	Seconds
		Brake Release Rate		0.4	0.1	2	Seconds
		Neutral Braking		10	0	100	%
		Neutral Taper Speed		500	200	6000	rpm
		Fine Tuning					
			Creep Torque	0	0	100	%
			Brake Full Creep Cancel	50	25	100	%
			Creep Build Rate	0.1	0.1	5	Seconds
			Creep Release Rate	3	0.1	5	Seconds
			Gear Soften	20	0	100	%
			Brake Taper Speed	1000	200	6000	rpm
			Reversal Soften	20	0	100	%
			Max Speed Decel	10	0.1	30	Seconds
Restraint							
	Restraint Forward			50	0	100	%
	Restraint Back			50	0	100	%
	Soft Stop Speed			0	0	500	rpm
	Position Hold						
		Position Hold Enable		Off	Off	On	

		Kp		10	2	100	%
		Kd		15	0	100	%
		Set Speed Settling Time		3013	0	5000	ms
		Set Speed Threshold		30	5	100	rpm
		Entry Rate		50	5	100	%
		Exit Rollback Reduction		50	0	100	%
Current Limits							
	Drive Current Limit			100	5	100	%
	Regen Current Limit			100	5	100	%
	Brake Current Limit			100	5	100	%
	EMR Current Limit			100	5	100	%
	Interlock Brake Current Limit			100	5	100	%
	Power Limiting Map						
		PL Nominal Speed		500	100	4000	rpm
		Delta Speed		500	50	1000	rpm
		Drive Limiting Map					
		Nominal		90	0	100	%
		Plus Delta		80	0	100	%
		Plus 2xDelta		75	0	100	%
		Plus 4xDelta		65	0	100	%
		Plus 8xDelta		35	0	100	%
		Regen Limiting Map					
		Nominal		100	0	100	%
		Plus Delta		100	0	100	%
		Plus 2xDelta		100	0	100	%
		Plus 4xDelta		100	0	100	%
		Plus 8xDelta		100	0	100	%
Throttle							
	Throttle Type			5	1	5	
	Forward Deadband			0.5	0	5	Volt
	Forward Map			35	0	100	%
	Forward Max			4.5	0	5	Volt
	Forward Offset			0	0	100	%
	Reverse Deadband			0.5	0	5	Volt

	Reverse Map			35	0	100	%
	Reverse Max			4.5	0	5	Volt
	Reverse Offset			0	0	100	%
	Throttle Filter			10	2	125	Hz
	HPD SRO Type			1	0	3	
	Sequencing Delay			0.1	0	5	Seconds
	VCL Throttle Enable			Off	Off	On	
Brake							
	Brake Pedal Enable			Off	Off	On	
	Brake Type			5	1	5	
	Brake Deadband			0.5	0	5	Volt
	Brake Map			50	0	100	%
	Brake Max			4.5	0	5	Volt
	Brake Offset			0	0	100	%
	Brake Filter			10	2	125	Hz
	VCL Brake Enable			Off	Off	On	
EM Brake Control							
	Brake Type			2	0	2	
	Pull In Voltage			100	0	100	%
	Holding Voltage			80	0	100	%
	Battery Voltage Compensated			On	Off	On	
	Set EM Brake On Fault			On	Off	On	
	Set Speed Threshold			30	5	100	rpm
	Release Delay			60	40	2000	ms
	Set Speed Settling Time			3013	0	5000	ms
	Torque Preload Delay			200	0	800	ms
	Torque Preload Enable			On	Off	On	
	Torque Preload Cancel Delay			0	0	120	Seconds
	EM Brake Fault Motor Revs			4	1	20	
Drivers							
	Main Contactor						
		Main Enable		On	Off	On	

		Pull In Voltage		100	0	100	%
		Holding Voltage		80	0	100	%
		Battery Voltage Compensated		On	Off	On	
		Interlock Type		0	0	2	
		Open Delay		0.1	0	40	Seconds
		Weld Check Enable		On	Off	On	
		Main DNC Check Enable		On	Off	On	
		Main DNC Runtime Threshold		5	0	200	Volt
		Precharge Enable		On	Off	On	
	Proportional Driver						
		PD Enable		Off	Off	On	
		Hyd Lower Enable		Off	Off	On	
		PD Max Current		0	0	2	Ampere
		PD Min Current		0	0	2	Ampere
		PD Dither %		0	0	100	%
		PD Dither Period		16	16	112	ms
		PD Kp		10	1	100	%
		PD Ki		10	1	100	%
	Driver 3						
		Contactor Enable		Off	Off	On	
		Pull In Voltage		100	0	100	%
		Holding Voltage		80	0	100	%
	Fault Checking						
		Driver 1 Checks Enable		On	Off	On	
		Driver 2 Checks Enable		Off	Off	On	
		Driver 3 Checks Enable		Off	Off	On	
		Driver 4 Checks Enable		Off	Off	On	
		PD Checks Enable		Off	Off	On	
		External Supply Max		200	0	200	mAmpere
		External Supply Min		0	0	200	mAmpere
	PWM Frequency			200	100	1000	Hz
Motor							
	Typical Max Speed			4000	500	8000	rpm
	Swap Encoder			Off	Off	On	

	Direction						
	Swap Two Phases			Off	Off	On	
	Encoder Steps			64	32	256	
	Encoder Options						
		Encoder Solution		0	0	2	
	Encoder Fault Setup						
		Fault Detection Enable		On	Off	On	
		Encoder Pulse Fault Detect Time		0.5	0	3	Seconds
		Fault Stall Time		5	0	10	Seconds
		LOS Upon Encoder Fault		On	Off	On	
		LOS Max Speed		800	100	2000	rpm
		LOS Max Current		400	100	650	Ampere
		LOS Max Mod Depth		50	15	100	%
		LOS Accel Rate		7	2	15	Seconds
		LOS Decel Rate		3	2	15	Seconds
	Temperature Control						
		Sensor Enable		On	Off	On	
		Sensor Type		3	1	5	
		Sensor Offset		0	-20	20	deg C
		Temperature Hot		145	0	250	deg C
		Temperature Max		160	0	250	deg C
		MotorTemp LOS Max Speed		800	100	3000	rpm
Battery							
	Nominal Voltage			24	24	84	Volt
	Undervoltage Cutback Range			7	2	14	Volt
	User Overvoltage			125	115	200	%
	User Undervoltage			70	50	80	%
	Reset Volts Per Cell			2.09	0.9	3	Volt
	Full Volts Per Cell			2.04	0.9	3	Volt
	Empty Volts Per Cell			1.73	0.9	3	Volt
	Discharge Time			34	0	600	Minutes
	BDI Reset			75	0	100	%

	Percent						
Dual Drive							
	Dual Motor Enable			Off	Off	On	
	Dual Motor Slave			Off	Off	On	
	CAN Node ID Other			2	0	127	
	LOS Max Speed			800	100	8000	rpm
	Master						
		Steer Angle Max (deg)		90	45	90	
		Turn Accel Rate		5	0.1	30	Seconds
		Critical Angle (deg)		70	45	90	
		Max Turn Speed		30	0	100	%
		Inner Wheel Speed		-100	-10 0	0	%
		Steer Type		5	1	5	
		Steer Pot Min		0.5	0	5	Volt
		Steer Pot Zero		2.5	0	5	Volt
		Steer Pot Max		4.5	0	5	Volt
		VCL Steer Enable		Off	Off	On	
	Slave						
		Turn Accel Rate		5	0.1	30	Seconds
		Critical Angle (deg)		70	45	90	
		Steer Fault Min		0.25	0	5.5	Volt
		Steer Fault Max		4.75	0	5.5	Volt
	Turn Feedforward						
		Turn Accel Rate		5	0.1	30	Seconds
		Turn Kvff		0	0	500	Ampere
		Turn ff Build Rate		1	0.1	5	Seconds
		Turn ff Release Rate		0.4	0.1	2	Seconds
Vehicle							
	Metric Units			Off	Off	On	
	Speed to RPM			691.3	10	3000	
	Capture Speed 1			4500	0	8000	rpm
	Capture Speed 2			4500	0	8000	rpm
	Capture Distance 1			22	1	1320	
	Capture Distance 2			100	1	1320	
	Capture Distance 3			150	1	1320	
Emergency Reverse							

	EMR Enable			On	Off	On	
	EMR Type			1	0	3	
	EMR Dir Interlock			On	Off	On	
	EMR Time Limit			5	0	30	Seconds
	EMR Speed			1000	50	6000	rpm
	EMR Accel Rate			1	0.1	3	Seconds
	EMR Decel Rate			1	0.1	3	Seconds
Interlock Braking							
	Enable			On	Off	On	
	Decel Rate HS			0.5	0.1	30	Seconds
	Decel Rate LS			0.5	0.1	30	Seconds
	Interlock Brake Timeout			5	0	8	Seconds
CAN Interface							
	CANopen Interlock			Off	Off	On	
	CAN Node ID 1			38	0	127	
	CAN Node ID 2			39	0	127	
	CAN Node ID 3			40	0	127	
	CAN Node ID 4			41	0	127	
	Supervisor Node ID			70	0	127	
	Baud Rate			0	-3	2	
	Heartbeat Rate			100	16	200	ms
	PDO Timeout Period			100	0	200	ms
	Emergency Message Rate			16	16	200	ms
	Suppress CANopen Init			0	0	1	
Motor Control Tuning							
	Motor Characterization Tests						
		Test Enable		0	0	1	
		Test Throttle		0	-1	1	
		Motor Poles		4	2	8	
		Max Test Speed		1000	500	3000	rpm
		Max Test Current		80	20	100	%
		SlipGain		3.85	0	200	

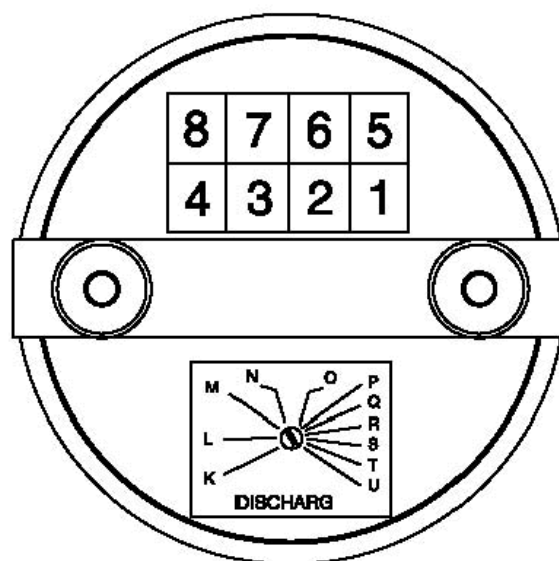
	Field Weakening Control						
		FW Base Speed		1550	200	6000	rpm
		Field Weakening		30	0	100	%
		Weakening Rate		40	0	100	%
		Min Field Current		0	0	800	Ampere
	Motor Type			0	0	205	
Reset Controller				0	0	1	

3.7 BATTERY INDICATOR

Type: CURTIS 803RB2448BCJ3010



Front View



Rear View

TERMINAL ASSIGNMENT

Pin 7 or 8 = Battery +. **Single voltage models:** Pin 8 to battery +; Pin 7, open. **Dual voltage models:** When vehicle voltage is the higher voltage of the 2 operating voltages, Pin 8 connects to battery +; Pin 7, open. When vehicle voltage is the lower of the 2 operating voltages, Pin 7 connects to battery +, Pin 8, open.

The discharge indicator uses Pin 7 or 8 for its battery state-of-charge measurements. Connection are to be made as close as possible to battery to prevent voltage drops that will cause errors in discharge indicator readings. The connection is not to be switched by the vehicle's keyswitch.

Pin 5 = Battery –

Connect to battery ground as close to battery as possible.

Pin 2 = Keyswitch. The keyswitch turns on and off the LED display of the battery discharge indicator. Monitoring of the battery continues when Pin 2 is turned off and the display is not lit. The hour meter display is unaffected by Pin 2, although it cannot accumulate more time as long as the keyswitch pin is not energized. The control inputs HRM (+) and HRM (–) are enabled by the keyswitch. Pin 2 is connected to the vehicle's keyswitch.

Pins 1 & 6 = Hour Meter Control. In normal operation, Pin 1 or 6 is connected and the other is left open. Only one of these pins is connected when using normal hour meter function. It is possible to or the hour meter between the two inputs so that it accumulates the total time either system is on. Hour meter

control logic is detailed in Table 2.

Pin 6 = Hour Meter +. HRM (+) (for use with a switched positive voltage). Pin 6 connects to a high voltage as defined in Table 1. to activate the hour meter. Leaving Pin 6 open or connecting it to a low voltage gives control of the hour meter to the Hour Meter (–) input. See Table 2.

Pin 1 = Hour Meter –. HRM (–) (for use with a switched ground). Pin 1 connects to a low voltage level as defined in Table 1 to activate the hour meter. Leaving Pin 1 open or connecting it to high voltage gives control of the hour meter to the Hour Meter (+) input.

Pin 3 = Relay. Pin 3 connects in series with the lift coil circuit (or the circuit to be switched at empty). For holding relay (J), Pin 3 must be electrically closer to battery + than Pin 4

Pin 4 = Relay. Pin 4 also connects in series with the circuit to be switched at empty.

HOURLY METER CONTROL LINES & IMPEDANCE SPECIFICATIONS

Low Voltage (max.)	High Voltage (min.)	Min. Impedance	
		HRM+	HRM-
5.0VDC	15.0VDC	80k Ω	20 k Ω

HOURLY METER CONTROL LOGIC

Pin 1 (HRM-)	Pin 6 (HRM+)	Hour Meter Status
High	Low	Off
High	Open	Off
Open	Low	Off
Open	Open	Off
Low	High	On
Low	Low	On
Low	Open	On
High	High	On
Open	High	On

DISCHARGE ADJUSTMENTS

The following table lists the voltages per cell under load that correspond to an empty indication on the gauge (lockout point).

Setting	K	L	M	N	O	P	Q	R	S	T	U
Volt/Cell at Empty	1.57	1.63	1.68	1.73*	1.78	1.82	1.84	1.86	1.89	1.91	1.93

NOTE: “*” – factory setting

RESET TYPE/LEVEL (AFTER OR DURING RECHARGE)

CTR = Charge Tracking Reset: If the gauge is connected to the battery during recharge, the gauge will track the battery charge level.

OCR = Open Circuit Reset: If the gauge is disconnected from the battery during recharge, the gauge will retain the last indication. It will advance to full when reconnected only if the battery voltage is above the OCR level. For standard (“B”) reset, OCR = 2.09 VPC (VPC = volts per cell.)

TROUBLESHOOTING

Problem	Possible Causes
No display	Terminals not connected or improper voltage
Stays at FULL	Instrument voltage does not match battery voltage, B+ connected to the wrong terminal
Will not reset	Instrument voltage does not match battery voltage, or battery not fully charged
Resets w/o charging battery	Not connected directly to battery terminals
EMPTY too soon	B+ connected to wrong terminal, or instrument voltage does not match battery voltage, or terminals not directly connected to battery

3.8 REPLACING THE ELECTRICAL PARTS



Lower the forks to the bottom and switch off electrical power before operation!



STEP 1: remove 4 screws from the control panel with 6mm Allen wrench.



STEP 2: remove the cover of the Electrical box with 6mm Allen wrench.

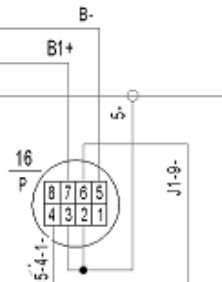
REPLACING OF THE BATTERY IINICOTOR



STEP 1: Unplug the connectors of the indicator, remove the screws, then you can remove it.



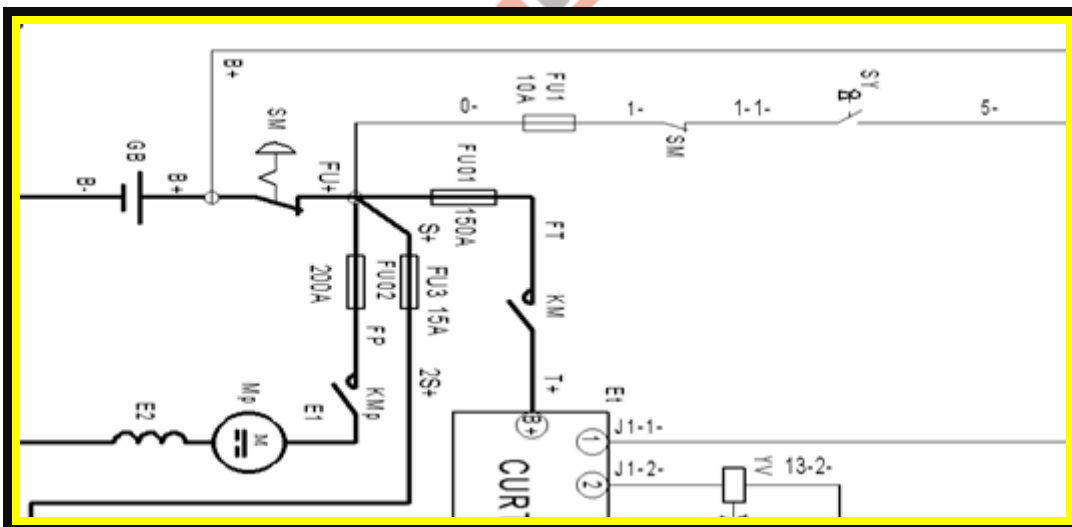
STEP 2: Remove 4 screws of the panel with 5mm Allen wrench.



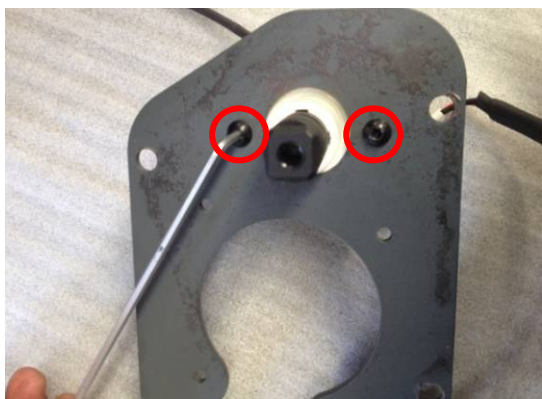
Instruction :

- ① Blank
- ②、③ positive pole input through the key switch
- ④ positive pole output
- ⑤ negative pole input
- ⑥ Positive pole input through the micro switch of control handle
- ⑦ positive pole input
- ⑧ Blank

B. REPLACING OF THE KEY SWITCH AND EMERGENCY SWITCH



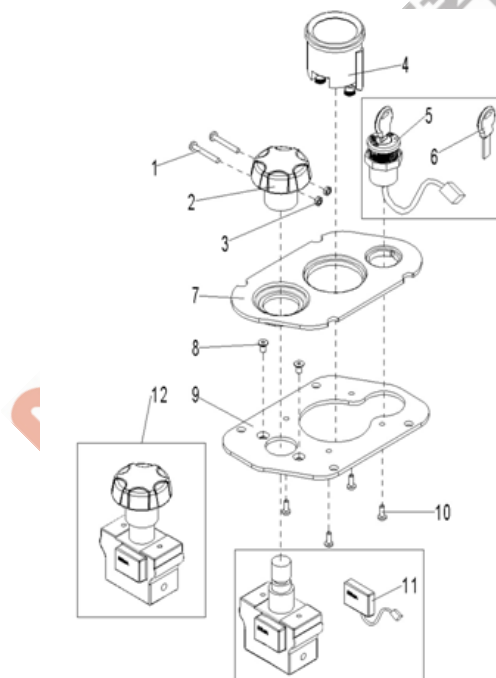
STEP 1: Remove 2 cables signed B+, FU+ of the emergency button with 14mm spanner.	STEP 2: Unplug the connectors (1- , 1-1-) of the emergency button with hand.
 The connectors are tight, so you should press the snap first and unplug it hard.	
	
STEP 3: Unplug the connectors (1-1-, 5-) of the key switch with hand.	STEP 4: Remove the panel.
	
STEP 5: Remove 4 screws of the panel with 2.5mm wrench.	STEP 6: Rotation the screws anticlockwise and then you can remove the key switch.
	
STEP 7: Remove 2 screws fixing the emergency button with cross wrench.	STEP 8: Remove the top cover of the emergency button.



STEP 9: Remove 2 screws fixing the emergency button with 3mm Allen wrench.



STEP 5: remove the black connector, and then you can replace the emergency button.



description	cause		management
no display	One pin or the entire pin without voltage		find out the cause
display	If ④ pin wit voltage	One cause: low voltage protection	need be charged;
		second cause: the indicator is broken	replace it.
no hour display	Inner part of the indicator is broken		replace the indictor

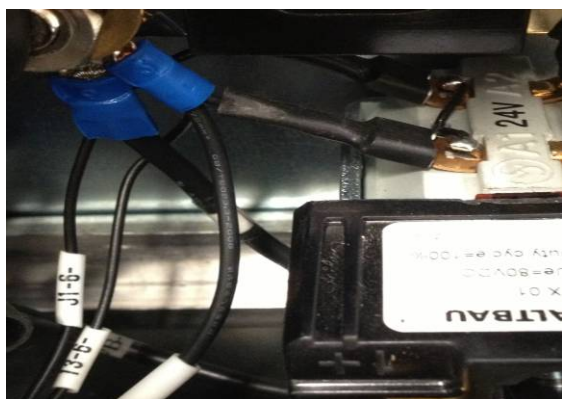
REPLACING OF THE CONTACTOR



STEP 1: Remove nuts of the contactor terminal with 13mm wrench.



STEP 2: Remove nuts of the fuse with 14mm wrench.



STEP 3: Unplug cables signed J1-6-, 13-6- of the contactor with hand.



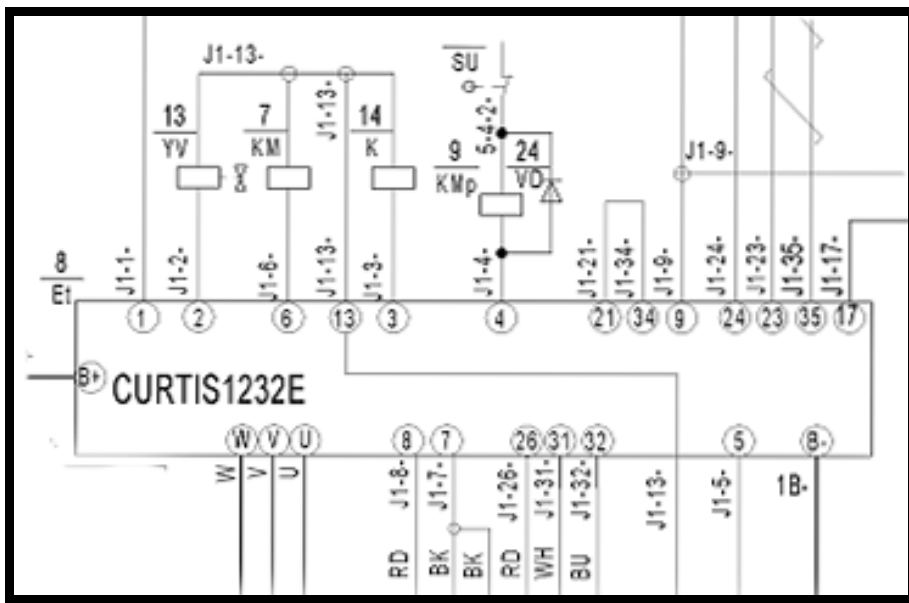
STEP 4: Remove 2 screws of the contactor then you can remove it.

REPLACING OF THE FUSE



Open the snap and then you can remove the fuse.

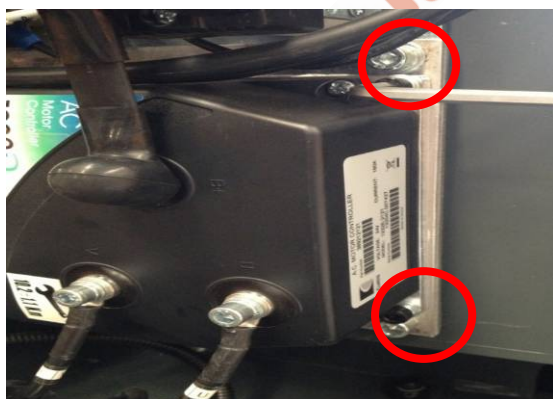
REPLACING OF THE CONTROLLER



STEP 1: Carefully remove the connector of control cables with hands.



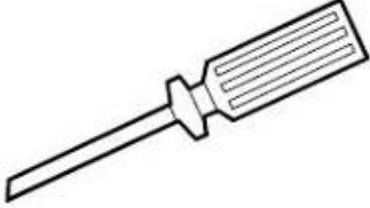

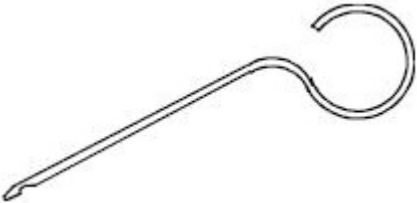
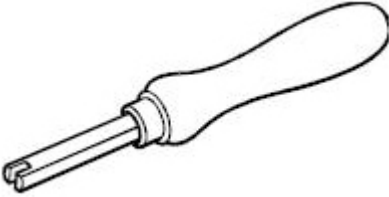
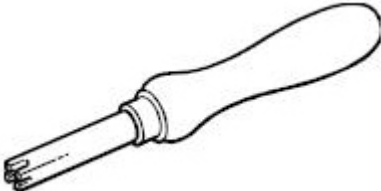

STEP 2: remove 5 screws fixing the cables (B+, B-, U, V, W) with 5mm Allen wrench.



STEP 4: Remove 2 screws with 6mm Allen wrench.

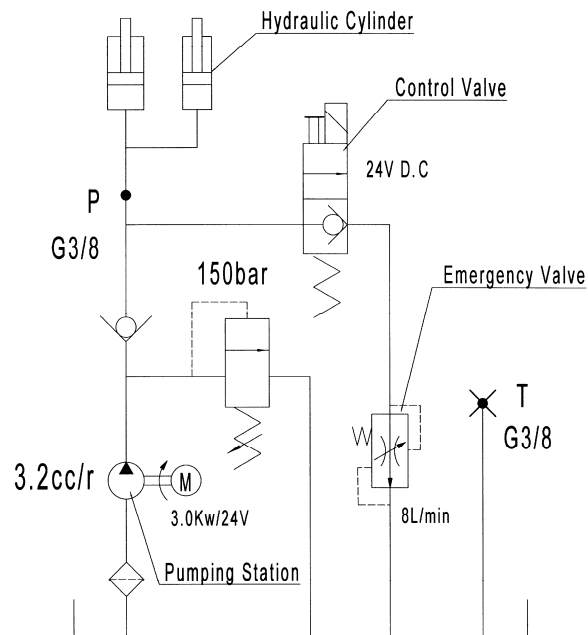
STEP 3: Remove 4 screws with 5mm Allen wrench and then you can remove the contactor and replace it.

3.9 TOOL FOR REPAIRING THE PIN OF ELECTRICAL PLUG

No.	Figure	Application
1		Tool for removal of pins / sleeves.
2		Tool for application of pins / sleeves
3		Tool for release of lock
4		Tool for application of secondary locking 2 – pole
5		Tool for application of secondary locking 4 – pole
6		Tool for removal of pins / sleeves

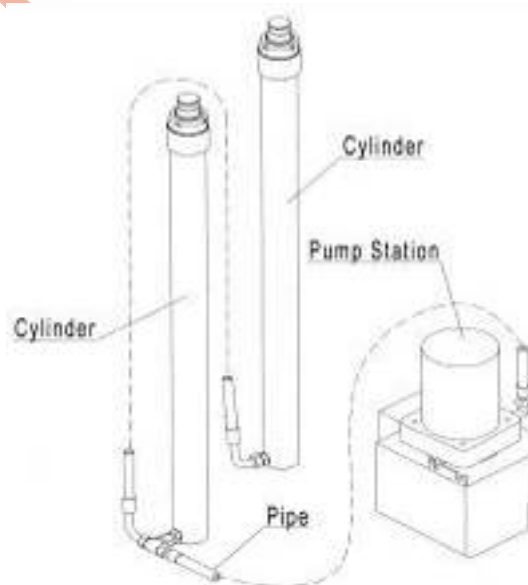
4. HYDRAULIC SYSTEM

4.1 HYDRAULIC FLOW DIAGRAM



INSPECTION OF HYDRAULIC OIL

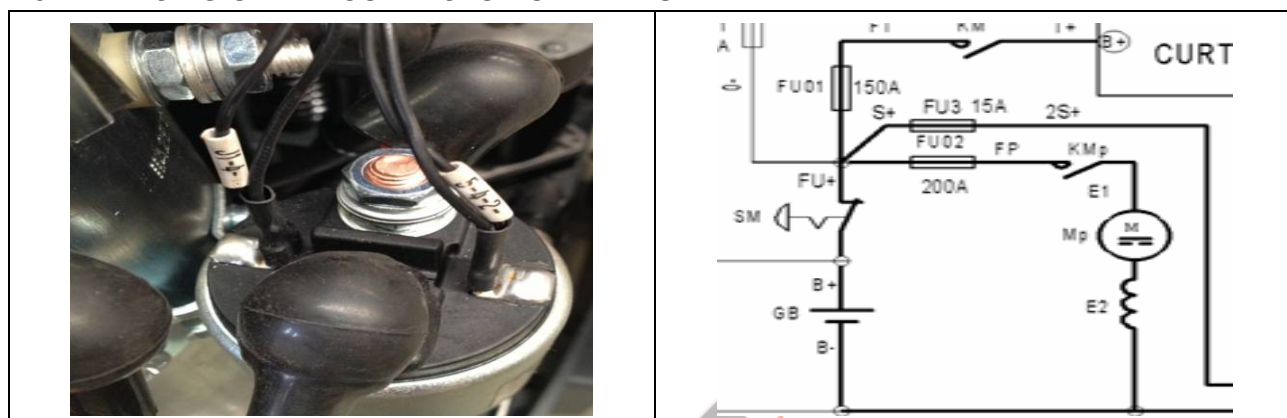
External appearance	Smell	Condition	Countermeasure
Clear and no discoloration	Fine	Fine	Possible to use
Clear but the color becomes bright	Fine	Mixed with other oil	Inspect the viscosity and if fine it can be continuously used
Color changed like milk.	Fine	Mixed with air and water	Separate water or replace oil.
Color changed into dark brown	Bad	Oxidized	Replace oil.
Clear but there are small black spots	Fine	Mixed with other particles	Use after filtering.



4.2 INSPECTION OF HYDRAULIC OIL

External appearance	Smell	Condition	Countermeasure
Clear and no discoloration	Fine	Fine	Possible to use
Clear but the color becomes brighte	Fine	Mixed with other oil	Inspect the viscosity and if fine it can be continuously used
Color changed like milk.	Fine	Mixed with air and water	Separate water or replace oil.
Color changed into dark brown	Bad	Oxidized	Replace oil.
Clear but there are small black spots	Fine	Mixed with other particles	Use after filtering.

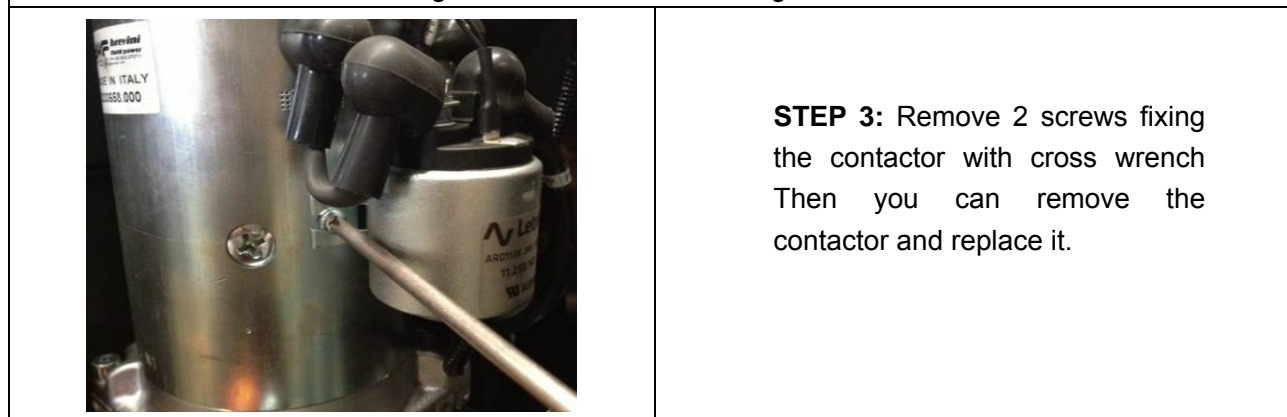
4.3 REPLACING OF THE CONTACTOR OF THE PUMP



STEP 1: Remove cables J1-4-、 5-4-2- fixing the contactor with hand.



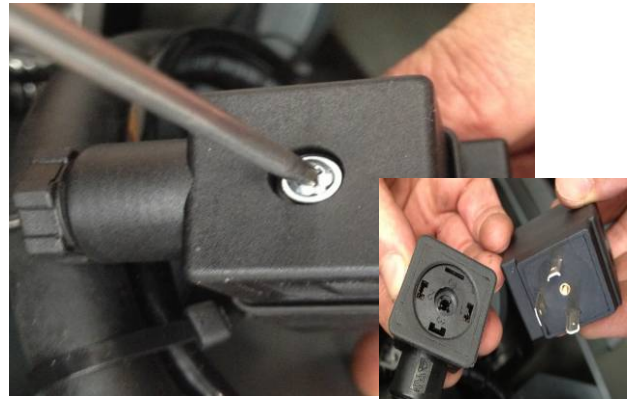
STEP 2: Remove cables FP fixing the contactor and E2 fixing the motor with wrench.



4.4 REPLACING OF THE LOWERING MAGNETIC VALVE

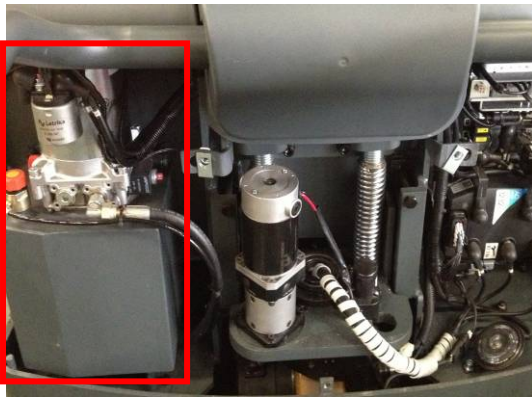


STEP 1: Remove the nut of the lowering magnetic valve with hand.



STEP 2: Remove the screws of the lowering magnetic valve with cross wrench and then you can replace..

4.5 REPLACING OF THE PUMP STATION



Lower the forks to the bottom before operation, the oil will spill over when operation; Keep clean for the stacker and yourself!



STEP 1: Remove the hydraulic pipe joint with 22mm wrench.



Watch out for the hydraulic oil spilling, check if the joint is dirty and clean it.



STEP 2: Remove the oil return pipe joint with 12mm wrench.



STEP 3: Remove 2 screws of the oil tank.



STEP 4: Remove 4 screws of the pump station, and then you can remove it.



STEP 5: You can remove the filter screen to replace it.

4.6 REPLACING OF THE CARBON BRUSH



STEP 1: Remove the screws fixing the cover of the pump station with cross wrench.



STEP 2: Remove the screws fixing the carbon brush with cross wrench.



STEP 3: Lever the carbon brush with wrench and then you can remove and replace it.



If you want to install the carbon brush to the box, you should vise the spring with nipper pliers!

4.7 REPLACING OF THE STEERING ASSISTED PARTS AND SENSOR



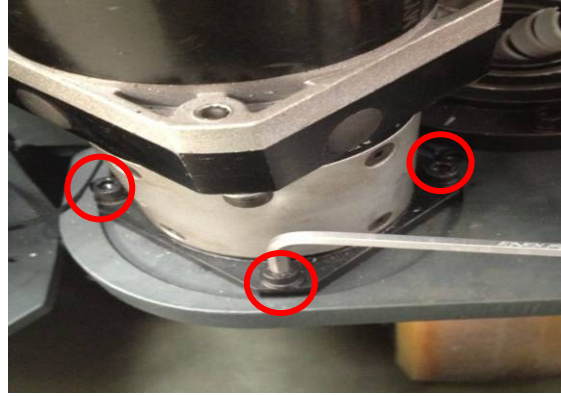
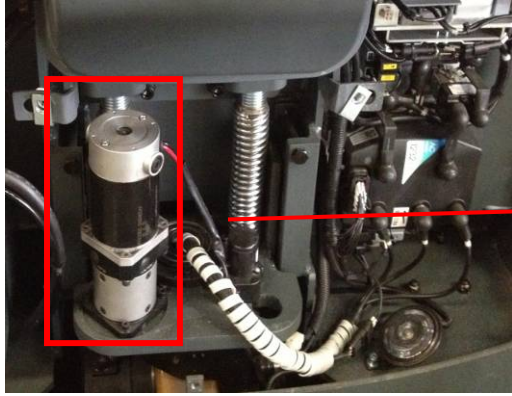
STEP 1: remove 4 screws of position sensor with screwdriver.



Xa : position sensor
 Pin 1: 24V steering Power input
 Pin 2 : blue cable: 0V
 Pin 5: brown cable: +5V
 Pin 6: green cable: Signal voltage

STEP 2: Dismantle the connector of the position sensor at Xa on the controller and remove it.

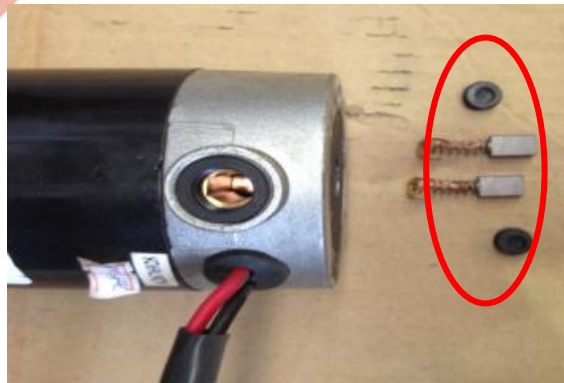
4.8 REPLACING THE STEERING MOTOR



STEP 1: remove 4 screws fixing the steering motor with 5mm Allen wrench and remove it.



STEP 2: Unplug the contactors and then you can remove the steering motor, as shown above.



STEP 3: Remove the rubber screw fixing the carbon brush, and then you can remove the carbon brush and replace it.

4.9 REPLACING OF THE CYLINDER



STEP 1: Remove the hydraulic pipe joint with 19mm wrench.



STEP 2: Remove oil return pipe joint with 12mm wrench.



Watch out for the hydraulic oil spilling, check if the joint is dirty and clean it.



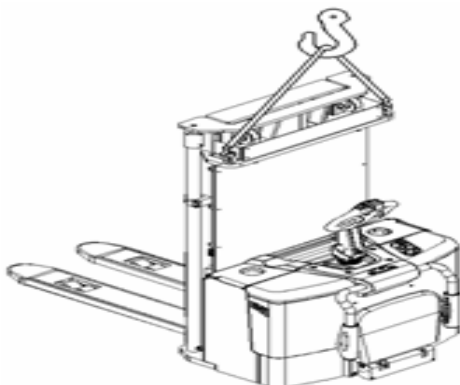
STEP 3: Remove 2 screws fixing the top of the cylinder and frame post with 10mm Allen wrench.



STEP 4: Remove 4 screws of the cylinder with 6mm Allen wrench and then you can remove it.

5. DRIVE WHEEL

5.1 REPLACING OF THE DRIVE WHEEL (WITH POWER-ASSISTED STEERING)



Take care of yourself when lifting up the truck!



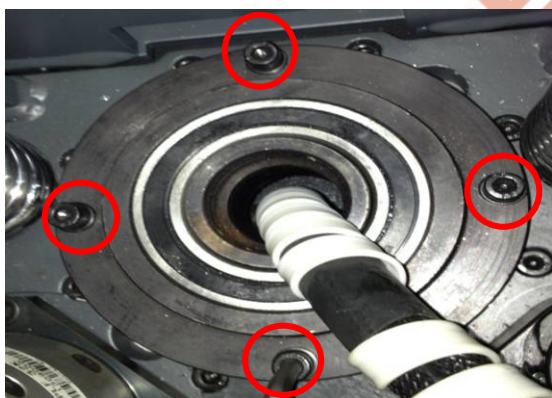
STEP 1: Remove screws fixing 3 wiring harness signed "U" "V" "W" of driving wheel with 10mm wrench.



STEP 2: Cut off the ribbon, dismantle the connectors, then 2 screws of the clamp with 3mm Allen wrench.



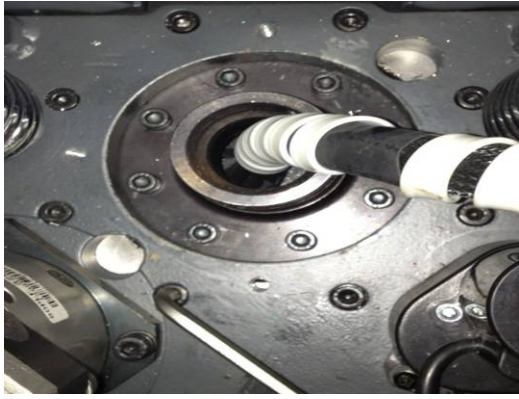
STEP 3: Remove 10 screws fixing the PU rim with 5mm wrench, and then you can remove and replace it.



STEP 4: Remove 4 screws with 5mm Allen wrench.



STEP 5: Remove the fixed plate with 2 wrenches, and then unplug the wiring harness.



STEP 6: Remove 8 screws fixing the wheel gear with 5mm Allen wrench and then you can remove the drive wheel.

5.2 REPLACING OF THE DRIVE WHEEL (WITHOUT POWER-ASSISTED STEERING)



STEP 1: Cut off the ribbon, dismantle the connectors, then 2 screws of the clamp with 3mm Allen wrench.



STEP 2: Unplug the contactors fixing the cables signed J1-51, 13-5- with hand. Then unplug the wiring harness.



STEP 3: Remove 4 screws fixing the drive wheel and axle with 8mm Allen wrench. Then you can remove and replace it.

5.3 REPLACING OF THE BALANCE WHEEL



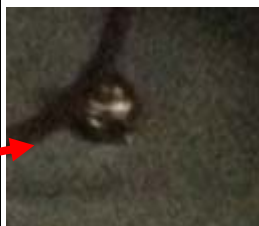
Vise the locknuts with 21mm wrench, and then remove the screws with 22mm wrench.



Adjust the quantity of the washers according to gaps of the wheel and wheel carrier until the wheel can rotate freely.

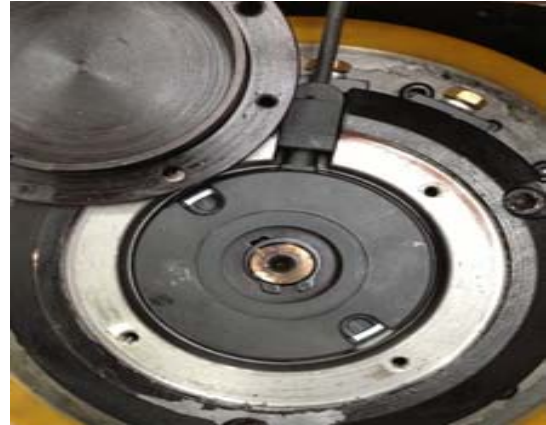


Vise the locknuts with 19mm wrench, remove 4 screws fixing the flange welded part with 10mm Allen wrench.

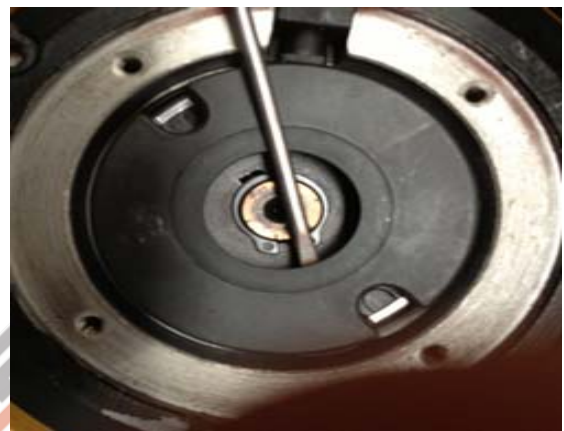


The other locknut is under the pump station, so you should dismantle the pump station first then you can remove the welded part.

5.4 REPLACE THE AC MOTOR SPEED SENSOR

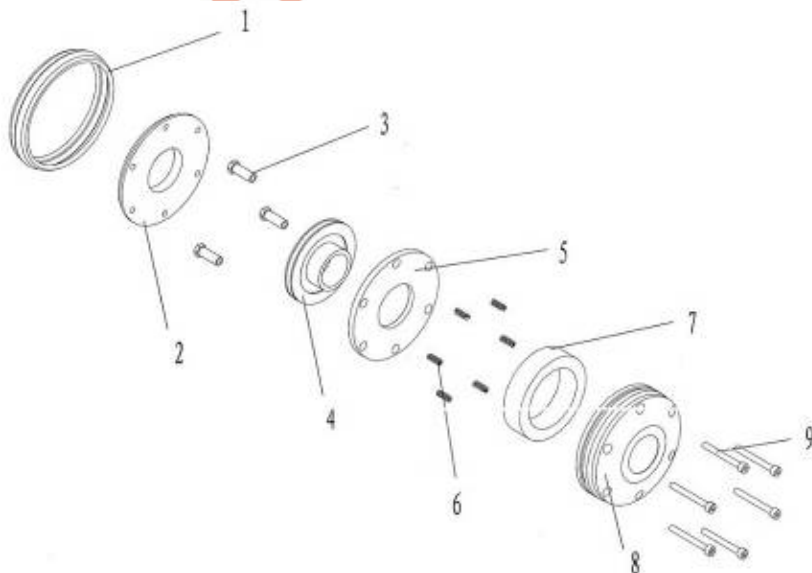


STEP 1: Remove 4 screws fixing the motor with 2.5mm wrench.



STEP 2: Tilt the sensor with screwdriver, then you can take out the sensor and replace it.

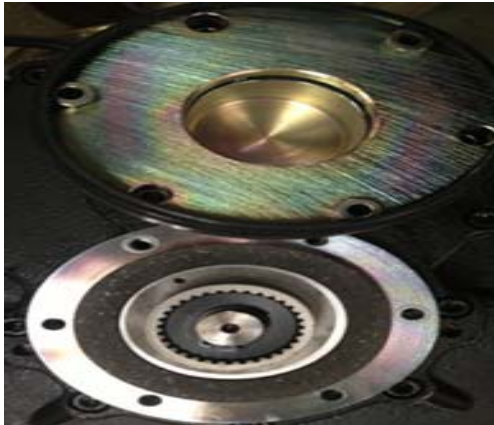
5.5 REPLACE OF THE BREAK



No.	Part name	No.	Part name
1	Gaiter	6	Spring
2	Friction plate	7	Carrier
3	Screw	8	Body magnetic
4	Break disk	9	Screw M5x45
5	Break anchor plate		1



STEP 1: Remove 6 screws with 6mm Allen wrench, and then you can remove the break.



STEP 2: Remove the break pad.

5.6 REPLACING OF THE POSITION SENSOR OF HANDLE



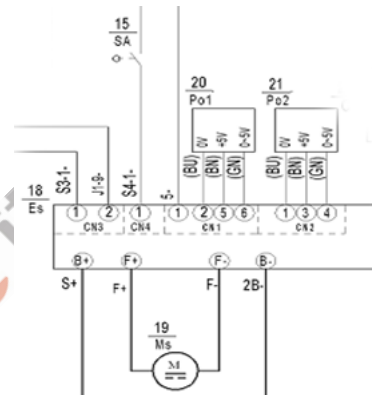
STEP 1: remove 3 screws of position sensor with 4mm Allen wrench.



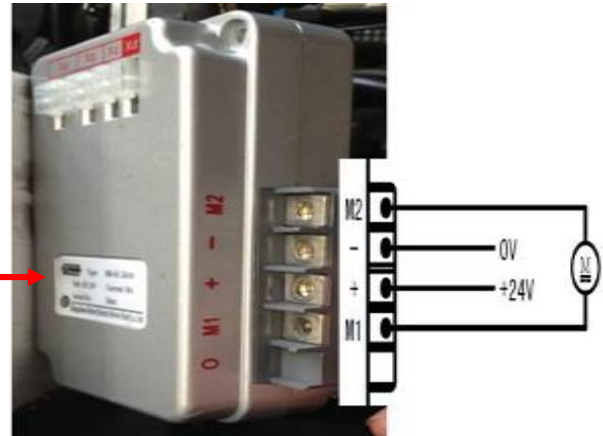
Xb: position sensor:
 Pin:1 blue cable: 0V
 Pin:3 brown cable: +5V
 Pin:4 green cable: Signal voltage

STEP 2: Dismantle the connector of the position sensor at Xb on the controller and remove it.

5.7 STEERING CONTROLLER



STEP 1: Dismantle 4 connectors of steering controller.

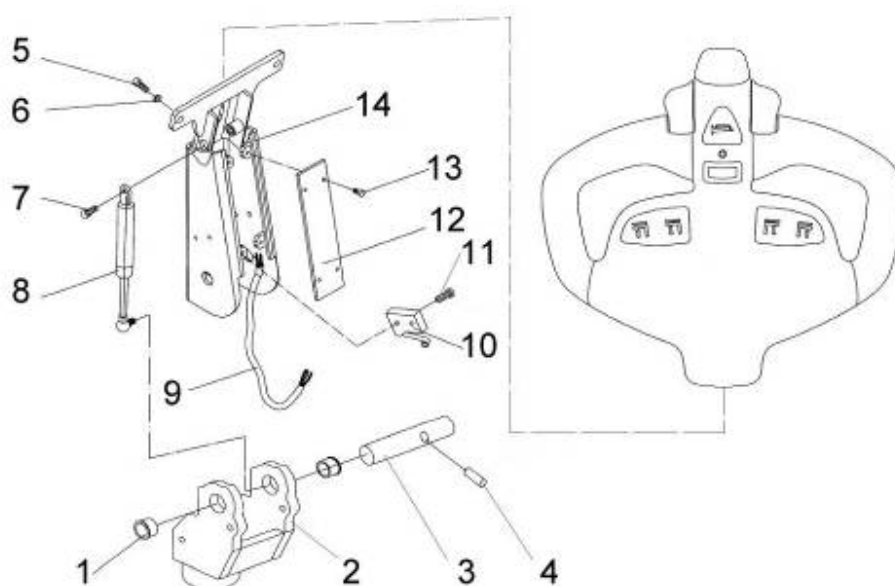


STEP 2: remove 4 screws fixing the cables to the controller with Philips screwdriver.

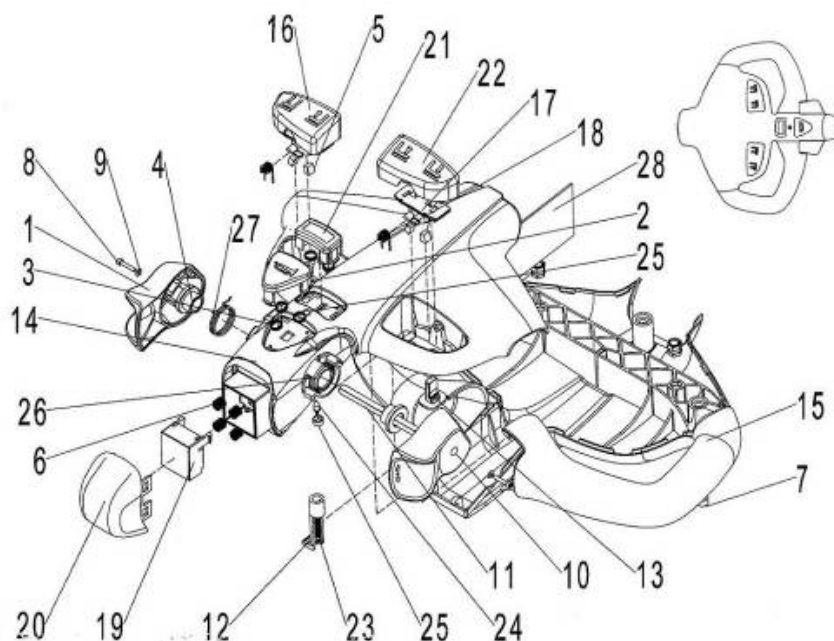


STEP 3: remove 2 screws fixing the steering controller, and then you can remove and check it.

6. CONTROL HANDLE



No.	Part name	No.	Part name
1	Bushing, 23/19*17*10	8	Air spring
2	Handle mounting bracket	9	Handle cable
3	Shaft, $\phi 17$	10	Micro switch Z-15GW2
4	Roll pin, $\phi 4 \times 24$	11	Screw, M4x25
5	Socket hex bolts M8x25	12	Cover
6	Elastic washer 8	13	Screw, M4x10
7	Socket hexa bolts M8X16	14	Tillerarm

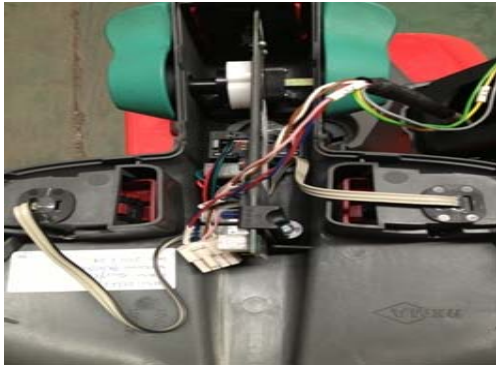


No.	Part name	No.	Part name
1	Butterfly left or throttle switch left	16	Seesaw-left or toggle button left
2	Button for horn	17	Magnet holder for seesaw
3	Spring	18	Hinge spring
4	Bearing for camshaft	19	Contact base
5	Magnet	20	Belly switch cover
6	Spring for belly button switch	21	Optional cover
7	Socket hexagonal Screw, M6X10	22	Seesaw right or toggle button right
8	Socket hexagonal Screw, M3X16	23	Tapping screw, ST4.2X25
9	Washer, 3	24	LED bicolor
10	Butterfly right	25	Housing for LED two parts
11	Edge Shaft	26	Spring RH throttle torsion
12	PCB-clip	27	Spring LH throttle torsion
13	Sensor for rocker lever	28	Printed board
14	Upper-part		
15	Lower-part		

6.1 REPLACING THE CONTROL HANDLE



STEP 1: Remove 3 screws fixing the back cover of the handle with 5mm Allen wrench.



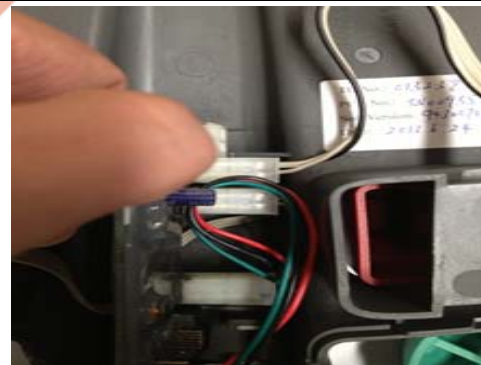
STEP 2: Unplug the connectors of the handle.



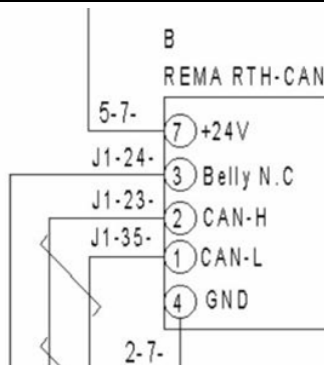
STEP 3: Remove 2 screws fixing the driving switch with 2.5mm Allen wrench.



STEP 4: Remove the driving switch axle.

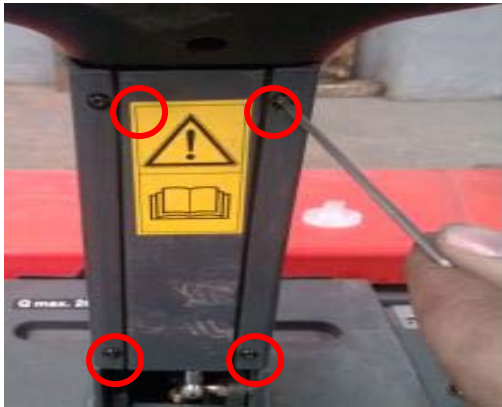


STEP 5: Remove the screws fixing the PCB board unplug the connectors and then you can replace the PCB board.



Don't miss the shaft sleeve when removing the PCB board.

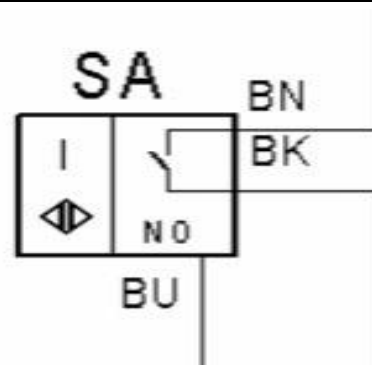
6.2 REPLACING OF THE INTERLOCK SWITCH



STEP 1: Remove 4 screws on back cover of handle with 2.5mm Allen wrench.



STEP 2: Dismantle 2 screws fixing SA from the left of the handle lever with 2.5mm Allen wrench.



6.3 REPLACING OF THE AIR SPRING



STEP 1: Knock the spring pin out with hammer.



STEP 2: Knock the handle axle out with hammer.



Take care of yourself in case the handle fall.

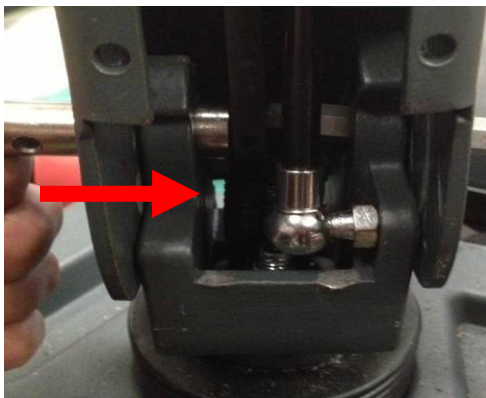
6.4 INSTALLATION OF THE AIR SPRING



STEP 1: Fix the upper screw of air spring with 6mm Allen wrench.



STEP 2: Tighten the below screws fixing the air spring with 12mm wrench.



STEP 3: Knock the handle axle into the hole with hammer.



STEP 4: Knock the spring pin into the hole with hammer.



When knocking the spring pin, it must be directly at the hole of the handle axle.

7. TROUBLE DIAGNOSTICS

7.1 REGULAR MAINTENANCE



- Only qualified and trained personnel are allowed to do maintenance on this truck.
 - Before maintaining, remove the load from the forks and lower the forks to the lowest position.
 - If you need to lift the truck, follow chapter 4b by using designated lashing or jacking equipment. Before working, put safety devices (for instance designated lift jacks, wedges or wooden blocks) under the truck to protect against accidental lowering, movement or slipping.
 - Please pay attention by maintain the tiller arm. The gas pressure spring is pre-loaded by compression, carelessness can cause injury.
 - Use approved and from your dealer released original spare parts.
 - Please consider that oil leakage of hydraulic fluid can cause failures and accidents.
 - It is allowed to adjust the pressure valve only from trained service technicians.
- If you need to change the wheels, please follow the instructions above. The castors must be round and they should have no abnormal abrasion.
- Check the items emphasized maintenance checklist.

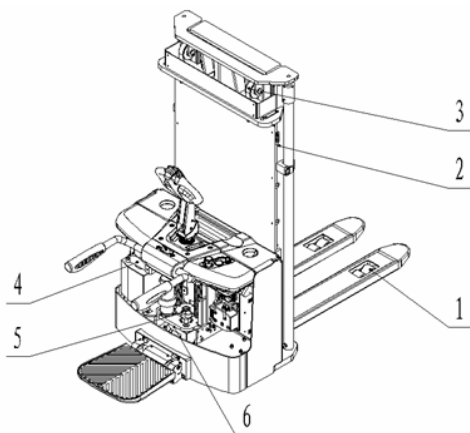
a. maintenance checklist

		Interval (Month)			
		1	3	6	12
	Hydraulic				
1	Check the hydraulic cylinder, piston for damage noise and leakage		•		
2	Check the hydraulic joints and hose for damage and leakage		•		
3	Inspect the hydraulic oil level, refill if necessary		•		
4	Refill the hydraulic oil (12 month or 1500 working hours)				•
5	Check and adjust the function of the pressure valve (1500 kg +0/ +10%)				•
	Mechanical system				
6	Inspect the forks for deformation and cracks		•		
7	Check the chassis for deformation and cracks		•		
8	Check if all screws are fixed		•		
9	Check mast and chain for corrosion, deformation or damages, replace if necessary	•			
10	Check the gearbox for noise and leakage		•		
11	Check the wheels for deformation and damages, replace if necessary		•		
12	Lubricate the steering bearing				•
13	Inspect and lubricate the pivot points		•		
14	Lubricate the grease nipples	•			
15	Replace the guarding and/or protective screen if it is damaged	•			
	Electric system				
16	Inspect the electric wiring for damage		•		
17	Check the electric connections and terminals		•		
18	Test the Emergency switch function		•		
19	Check the electric drive motor for noise and damages		•		
20	Test the display		•		
21	Check if correct fuses are used, if necessary replace.		•		
22	Test the audio warning signal		•		
23	Check the contactors		•		

24	Check the frame leakage (insulation test)		•		
25	Check function and wear of the accelerator		•		
26	Check the electrical system of the drive motor		•		
Braking system					
27	Check brake performance, if necessary replace the brake disc or adjust the air gap		•		
Battery					
28	Check the battery voltage		•		
29	Clean and grease the terminals and check for corrosion and damage		•		
30	Check the battery housing for damages		•		
Charger					
31	Check the main power cable for damages			•	
32	Check the start-up protection during charging			•	
Function					
33	Test the audio warning signal	•			
34	Check the air gap of the electromagnetic brake	•			
35	Test the emergency braking	•			
36	Test the reverse and regenerative braking	•			
37	Test the safety (belly) button function	•			
38	Check the steering function	•			
39	Check the lifting and lowering function	•			
40	Check the tiller arm switch function	•			
41	Test the key switch of damages and function	•			
42	Test the speed limitation switch (lifting height >~300mm)	•			
General					
43	Check if all decals are legible and complete	•			
44	Check if the protective screen and or guarding is not damaged	•			
45	Inspect the castor, adjust the height or replace it, if worn out		•		
46	Carry out a test run	•			

b. Lubricating points

Lubricate the marked points according to the maintenance checklist. The required grease specification is: DIN 51825, standard grease.



- 1 Bearings in wheels
- 2 Main frame post
- 3 Chain
- 4 Hydraulic system
- 5 Steering bearing
- 6 Gear box

c. Check and refill hydraulic oil

The required hydraulic fluid- type is

- H-LP 46, DIN 51524
- Viscosity is 41.4 - 47
- Depending on the type the amount
Is 8L

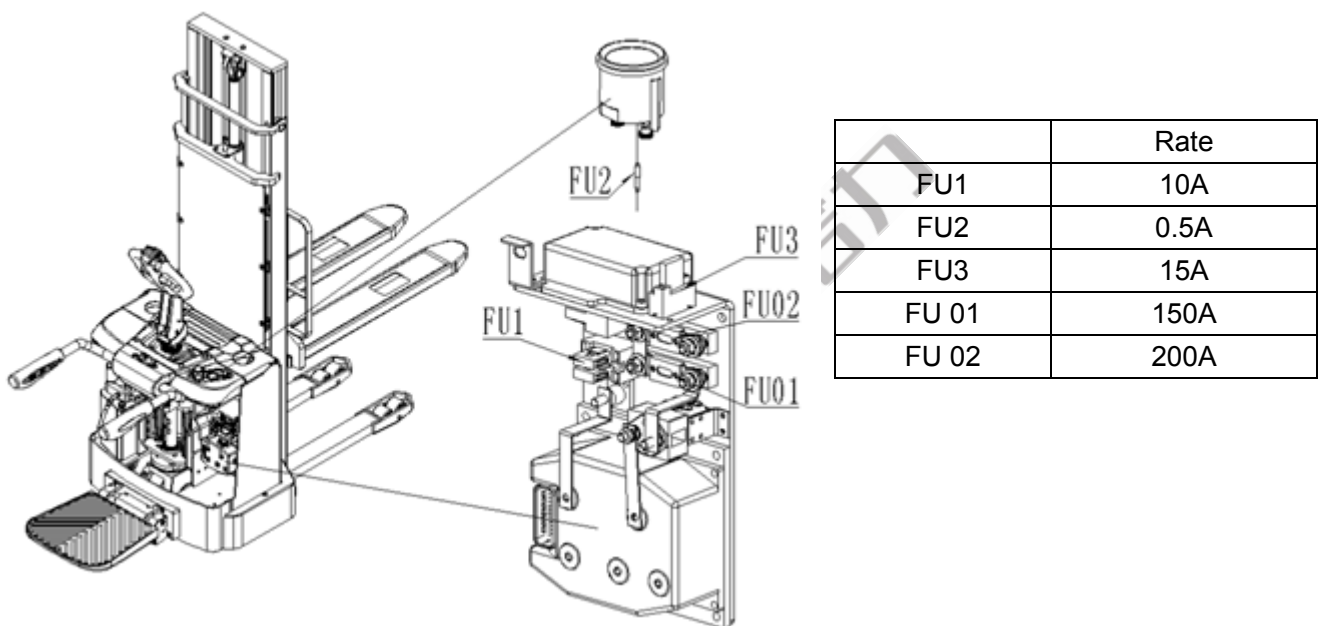
Waste material like oil, used batteries or other must be probably disposed and recycled according to the national regulations and if necessary brought to a recycling company.

The oil level height shall be in the not lifted position min.7.9L to 8.1L.

If necessary add oil at the filling point.

d. Checking electrical fuses

Remove the main cover.



e. Removing, reattaching guarding



DO NOT USE THIS TRUCK, IF THE GUARDING IS DAMAGED OR NOT CORRECTLY ASSEMBLED!

If the guarding needs to be removed, unbolt the fixing screws and remove the screen carefully. The screws will remain with the screen. For reattaching place the screen to the right position and fix each screw correctly. If you need to replace parts, please call your next service partner.

Move the clips for the protective screen sideways and remove the screen. Assembling is in the opposite direction. Please make sure that the the screen is fixed correctly and that the fixing elements are not damaged.

7.2 TROUBLE SHOOTING



- If the truck has malfunctions follow the instructions.

TROUBLE	CAUSE	REPAIR
Load can't be lifted	Load weight too high	Lift only the max. capacity, mentioned on the ID-plate
	Battery discharged	Charge the battery

	Lifting fuse faulty	Check and eventually replace the lifting fuse
	Hydraulic oil level too low	Check and eventually refill hydraulic oil
	Oil leakage	Repair the hoses and/or the sealing of the cylinder
	Lifting stops at ~1800mm	Move the protective arms into the downside position
	Lifting stops at ~1800mm	Check the sensor for the protective arm
	Height sensor for 1800mm height defect	Check the height sensor on the mast
Oil leakage from air breathing	Excessive quantity of oil.	Reduce oil quantity.
Stacker not starts operating	Battery is charging	Charge the battery completely and then remove the main power plug form the electrical socket.
	Battery not connected	Connect the battery correctly
	The fuse is faulty	Check and eventually replace fuses
	Battery discharged	Charge the battery
	Combined emergency switch is activated	De-activate the combined emergency switch by insert and pull the knob.
	Tiller in the operating zone	Move the tiller firstly to the braking zone.
	Protective arms in the upright position, platform folded upright	Move the protective arms into the downside position
	Foldable platform or protective arms in one of the allowed positions	Check the proximate sensors for the arms and platform
	Foldable platform or protective arms not in one of the allowed positions	Check the correct function of the arms and/or platform
Only travelling in one direction	The accelerator and the connections are damaged.	Check the accelerator and the connections.
The stacker only travels very slowly	The battery is discharged.	Check the battery status at the discharge indicator
	The electromagnetic brake is engaged.	Check the electromagnetic brake
	The relating tiller cables are disconnected or damaged	Check the tiller cables and connections.
	Defective height sensor for reduced speed at ~300mm height	Check the sensor
	Electric system overheated	Stop using and cool down the truck
	Defective heat sensor	Check and if necessary replace the heat sensor
The stacker starts up suddenly	The controller is damaged.	Replace the controller.
	The accelerator not moves back to its neutral position.	Repair or replace the accelerator.

If the truck has malfunctions and can't be operated out of the working zone, jack the truck up and go with a load handler under the truck and safe the truck securely. Then move truck out of the aisle.